PAGE'S WEEKLY.—February 17, 1905. This Paper Copy for Circulation Abroad.

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PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

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ITALY, Rome: 307 Corso.
AUSTRIA, Vienna: Kärntnerstrasse, nr. 30.

INDIA, Calcutta: Thacker, Spink & Co.
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" Chicago: Subscription News Co.
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PAGE'S WEEKLY

Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.

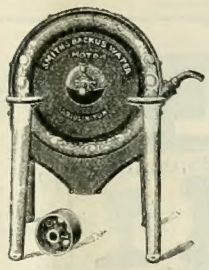
ED. BRAND,

MECHANICAL ENGINEER,
35, SHAKESPEARE STREET, MANCHESTER.

Modern Wire-Working Machinery,

Such as for Rolling, Drawing, Weaving, Netting, Forming, Automatic Straightening and Cutting, Cabling, Testing, &c.

Inquiries Solicited. Teleg. Address: "Filieres, Manchester."



CHEAP POWER.

SMITH'S

Backus Water Motors

1/16 to 10 H.P.

Will drive any class of Machinery, and work on 15 lb. pressure.

ERIC S. A. SMITH, ENGINEER,

APPLY FOR CATALOGUE. **BRIDLINGTON.**

Second Edition, Revised. Price 7s. 6d.

DEPRECIATION OF FACTORIES, Mines, and Industrial Undertakings, and their Valuation. With Tables and Examples.

By EWING MATHESON, M.Inst.C.E.

The Principles which should guide the Writing off for wear and tear, Obsolete plant; Terminable or wasting properties; Effect on Income-tax; Value defined as for Compulsory purchase; Going concern, or dismantled; Rateable value, rental value.

"A successful attempt to systematise existing information and to make it possible to arrive at uniformity and accuracy in making up balance sheets for valuations. The work is unique of its kind."—*The Engineer.*

E. & F. N. SPON, 125, Strand, London.

JOSEPH BOOTH BROS., LTD., RODLEY, LEEDS. See next week.

LIFTING MACHINERY.

THOS. W. WARD, ALBION WORKS, SHEFFIELD. See Page 22.

MACHINE TOOLS.

THE SHANNON, LTD., Ropemaker St., London, E.C. See Page 86.

OFFICE APPLIANCES.

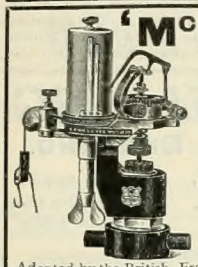
Have you seen our Advertisement on page ~~69~~ 61. A glance at it may save you £500 per annum.—ED. BENNIS & CO., Ltd., BOLTON.

PAGE & ROWLINGSON,

Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.



'McINNES-DOBBIE' INDICATORS.

In Two types: External and Enclosed Pressure Springs.

Each made in several forms and sizes to suit all speeds and pressures.

Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

DOBBIE McINNES, LIMITED,

Adopted by the British, French, and Japanese Admiralties. **45, BOTHWELL ST., GLASGOW.**

"UNICA" SILENT GEARS

Equal in STRENGTH to, and MORE DURABLE than, Cast Iron, Gun Metal, or Rawhide.

NO SIDE PLATES OR BUSHES! UNAFFECTED BY OIL!

Have stood test of four years.

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Telegrams: "Verdampfer, London." **145, Cannon St., LONDON.**

HARTLEY & SUGDEN, LIMITED · TRADE MARK · H & S Hx · HALIFAX ·

Heating Apparatus

BOILERS

Wrot Welded Iron and Cast Iron Sectional

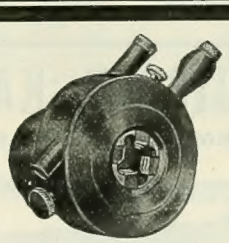
VERTICAL STEAM BOILERS

Apply for Catalogue.

"THOMPSON" DISH ENDED LANCASHIRE BOILERS

can be supplied ex-stock. Advantages: Overcomes grooving on end plate and cracking of flue flanges; freedom for expansion; no stay plates or leaky stay rivets; firebox easily cleaned.

JOHN THOMPSON, WOLVERHAMPTON.



HARTNESS AUTOMATIC OPENING DIE

The most satisfactory means yet devised for the production of screw threads.

JONES & LAMSON MACHINE CO.,

JUBILEE BUILDINGS,

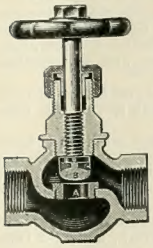
97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY — Miscellaneous

PAGE'S WEEKLY

Miscellaneous

The "SHAW" Patent Steam Valves . .



With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them! Sent on Approval.

Write for particulars of these and other Specialities for High Pressure Steam.

JOSEPH SHAW, B Dept., Albert Works, HUDDERSFIELD.

Contractors to H.M. Government.

BRADBURY & CO., LTD.

Capstan Lathes and Labour Saving Tools.

TRADE MARK — BRADBURY & COMPANY LIMITED — WELLINGTON WORKS OLDHAM — DUKE OF WELLINGTON

WELLINGTON WORKS, OLDHAM.

Lists Free.

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in any part of the United Kingdom, for which work special terms will be sent on application, distance being no object.

ONLY ADDRESS:—

55, Baker Street, LONDON, W.

Telegrams: PHOTICS, LONDON. Telephone: 293 PADDINGTON.

Refuse Destructors.

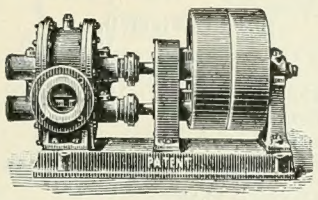
Write for particulars to:—

HEENAN & FROUDE, LIMITED

4 Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

ENKE'S ROTATIVE PUMP.



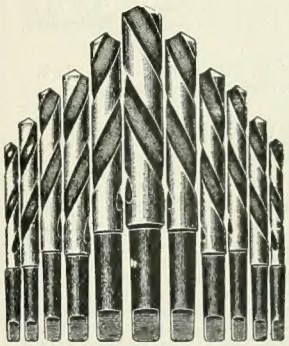
Best of all Systems for all Liquids.

4,000 Pumps under my System (with a capacity up to 15,000 litres per minute) in use.

ENKE'S PRECISION BLOWER.

Entirely of Iron without packing for high pressures to 0·3 atm.

CARL ENKE, Schkeuditz-Leipzig, GERMANY.



Twist Drills,

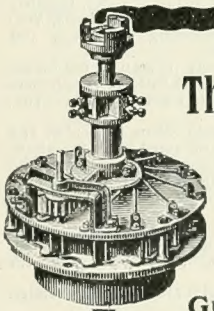
Taps,

Milling Cutters,

Reamers.

H. F. SCHNICKE,

CHEMNITZ (Saxony).



The TRENT TURBINE

Convenient for Low Falls.

ALSO . . .

VORTEX, GIRARD, AND LUNEDALE TYPES.

GILBERT GILKES, & Co., Ltd. KENDAL.

PAGE'S WEEKLY

Contracts

CONTRACTS.

BOROUGH OF NEWCASTLE-UNDER-LYME.

SEWAGE DISPOSAL WORKS.

TENDERS are invited for the MANUFACTURE, DELIVERY, and ERECTION of THREE SETS of GAS ENGINES and CENTRIFUGAL PUMPS.

Specifications and Drawings may be obtained at the offices of the Engineers, Messrs. WILLCOX AND RAIKES, Union Chambers, 63, Temple Row, Birmingham, on or after Wednesday, February 1st, 1905, on payment of a deposit of Two Guineas, which will be refunded (after the Contract has been decided upon) to those persons who have sent in a *bonâ fide* Tender, and who have refunded the whole of the documents entrusted to them.

Sealed Tenders, upon the forms supplied, endorsed "Sewage Pumping Machinery," to be delivered at my office not later than 12 o'clock noon on Wednesday, February 22nd, 1905.

Contracts will only be given to firms paying the standard rate of wages of their districts.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JOSEPH GRIFFITH,
Town Clerk.

Town Hall, Newcastle-under-Lyme, Staffordshire.

METROPOLITAN BOROUGH OF FULHAM.

ELECTRICITY DEPARTMENT.

The Establishment Committee are prepared to receive TENDERS for the Supply and Erection of—

A. CONDENSING PLANT.
B. BOILERS.
C. ECONOMISERS.
D. STOKERS.

Specification, Drawings, and Forms of Tender may be obtained from the Borough Electrical and Consulting Engineer, Mr. ARTHUR J. FULLER, after the 8th inst., on payment of a deposit of One Guinea, which will be returned on receipt of a *bonâ fide* Tender.

Tenderers are requested to state which section they wish to tender for.

Tenders, made out on Form supplied, addressed to the Town Clerk, Town Hall, Fulham, and endorsed "Tender for Contracts 'L,'" to be delivered at the Town Hall not later than Twelve noon on Wednesday, the 22nd inst., 1905.

The lowest or any Tender not necessarily accepted.

R. M. PRESCOTT, Town Clerk.

Town Hall, Fulham, February 1st, 1905.

WESTERN VALLEYS (MON.) SEWERAGE BOARD.

CONTRACT No. 1.

CONSTRUCTION OF MAIN OUTFALL AND BRANCH SEWERS.

Notice is Hereby Given that the Western Valleys (Mon.) Sewerage Board are prepared to receive TENDERS for the CONSTRUCTION of the above WORKS, consisting of the Main Outfall Sewer, Tank Sewer, and Sea Outfall, from Aberbeeg to low-water mark in the Bristol Channel, about 17¼ miles in length varying from 2ft. 6in. to 11ft. in diameter, of brick, concrete, cast iron and steel; the Nantyglo Branch, from Nantyglo to Aberbeeg, about 6½ miles in length, varying from 12in. to 21in. in diameter, of earthenware and steel pipes; the Cwmtillery Branch, about 1½ miles in length, 12in. and 15in. in diameter, of earthenware and steel pipes; the Ebbw Vale Branch, from Beaufort to Aberbeeg, about 8½ miles in length, varying from 12in. to 18in. in diameter, of earthenware and steel pipes; being a total length of about 35 miles, together with Penstock Chamber, Manholes, Chambers, Inspection Shafts, Ventilators, Penstocks, Storm Overflows, Connecting Chambers, and Miscellaneous Works in connection therewith.

Drawings and Specification of the Works may be seen at my offices as below, at the offices of Mr. BALDWIN LATHAM, M.Inst.C.E., Parliament Mansions, Victoria Street, Westminster, and Mr. GEORGE CHATTERTON, M.Inst.C.E., 6, The Sanctuary, Westminster.

A limited number only of the quantities, specifications, schedules, and forms of Tender are available, and may be obtained from the above Engineers, on deposit of £25 (crossed cheque only), which will be returned, after a contract has been entered into, to every person who has sent in a *bonâ fide* Tender, and has returned the documents entrusted to him.

Sealed Tenders on the forms supplied, endorsed "Tender for———— Sewerage Works, Contract No. 1," are to be delivered at my offices, 24, Stow Hill, Newport, Mon., on or before 11 a.m., on Saturday, the 8th day of April, 1905.

The Board do not bind themselves to accept the lowest or any Tender.

Dated this 10th day of February, 1905.

T. S. EDWARDS,
Clerk to the Western Valleys (Mon.) Sewerage Board
24, Stow Hill, Newport, Mon.

GREAT WESTERN RAILWAY.

The DIRECTORS of this Company are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the FOLLOWING PLANT in connection with their Electricity Generating Station at Park Royal and proposed Sub-Stations and Distributing Centres at various places:—

SPECN. 11.—High and Low Tension 3-Phase and Direct-current Switch-boards and Battery Boosters at Park Royal. All Sections must be tendered for.

SPECN. 14.—3-Phase Static Transformers and High and Low Tension Switch-boards at various Sub-stations and Lighting Distributing Centres between Paddington and Park Royal and Paddington and Hammersmith. All Sections must be tendered for.

SPECN. 15.—High and Low Tension 3-Phase and Direct-Current Switchboards at Royal Oak, Shepherd's Bush, and Old Oak Common Sub-stations.

Sec. A.—3-Phase Switchboards.
„ B.—Direct Current Switchboards.
„ C.—Six Motor-driven Boosters (Four Reversible and two Milking) in connection wtth Storage Batteries at Royal Oak and Shepherd's Bush Sub-stations.

All Sections should be tendered for if possible, but Tenders for Section A alone or for Sections B and C together will be considered. The Company reserve the right of accepting a Tender for any one of the different Sections alone.

Copies of the Specifications, Forms of Tender, Drawings and General Conditions can be obtained on and after Tuesday, the 14th instant, at the offices of the Consulting Engineers, Messrs. KENNEDY AND JENKIN, 17, Victoria Street, London, S.W., between the hours of 10 a.m. and 4 p.m., on payment of Two Guineas for each Specification, which will be refunded on the receipt of a *bonâ fide* Tender. The fee, which must be paid by cheque, will not be returnable until the Tenders have been adjudicated upon.

Tenders, addressed to "The Secretary, Great Western Railway, Paddington Station, W.," and marked outside "Tender for Electric Power and Lighting—Specification No. '11,' '14,' or '15,'" as the case may be, will be received on or before Monday, March 13th.

The Directors do not bind themselves to accept the lowest or any Tender, and no allowance will be made for any expense incurred in the preparation of a Tender.

G. K. MILLS,
Paddington Station, London, February 8th, 1905. Secretary.

TENDERS FOR GALVANISED WROUGHT IRON PIPING AND FITTINGS.

THE CROWN AGENTS FOR

the Colonies, acting on behalf of the Uganda Railway, INVITE TENDERS from manufacturers for the SUPPLY OF GALVANISED WROUGHT IRON PIPING and FITTINGS, Specification and form of Tender for which can be obtained on application to the Crown Agents, between the hours of 10 a.m. and 4 p.m. (Saturday 10 to 1).

Tenders to be delivered in sealed envelope, addressed to the Crown Agents for the Colonies, Whitehall Gardens, S.W., and endorsed "Tender for Galvanised Wrought Iron Piping and Fittings, Uganda Railway," not later than noon on February 22nd, 1905.

The Crown Agents do not bind themselves to accept the lowest or any tender.

GLEMSFORD WATER SUPPLY.—The

Glemsford Urban District Council are prepared to receive TENDERS for the following:—

CONTRACT No. 2.—CAST IRON PIPES and SPECIALS: 2¾ miles of 5, 4, and 3in. Socket Pipes, Bends, Branches, &c.

CONTRACT No. 3.—LAYING and JOINTING about 2¾ miles of CAST IRON PIPES, FIXING SLUICE VALVES, HYDRANTS, &c.

CONTRACT No. 4.—ERECTION of BRICK WATER TOWER about 19ft. diameter and 45ft. high; also a PUMPING STATION.

CONTRACT No. 5.—One 13 B.H.P. OIL ENGINE and ONE VERTICAL THREE-THROW RAM PUMP with all accessories.

CONTRACT No. 6.—STEEL TANK, 20ft. 3in. diameter by 15ft. 6in. deep, erected on Water Tower.

Plans may be seen and specifications and quantities obtained from the Engineer, Mr. J. T. EAYRS, M.Inst.C.E., Clarence Chambers, 39, Corporation Street, Birmingham, on and after the 11th inst., on payment of a deposit of Two Guineas in respect of each contract, which will be repaid only on receipt of a *bonâ fide* Tender, and the return of all the documents fully priced in.

Plans in connection with Contracts 3 and 4 may also be inspected at the office of the Surveyor to the District Council of Glemsford.

Tenders to be sent in addressed to me on or before the 1st day of March, 1905, endorsed "Water Supply Contract No.—" as the case may be.

The Council do not bind themselves to accept the lowest or any Tender.

THOS. BATES, Clerk to the Urban District Council.

Glemsford, Suffolk, February 1st, 1905.

PAGE'S WEEKLY — Contracts

METROPOLITAN BOROUGH OF ISLINGTON.

CONTRACTS FOR ELECTRICAL AND ENGINEERS' STORES.

The COUNCIL of the above Borough will meet on Friday, the 24th February, 1905, at Eight o'clock in the Evening, to consider TENDERS for CONTRACTS for One Year from April 1st, 1905, as under :—

SECTION A.—Meters.
" B.—Time Switches.
" C.—Earthenware Pipes.
" D.—Carbons.
" E.—Incandescent Lamps.
" F.—Terminal Boxes.
" G.—Arc Lamp Globes.
" H.—Oils and Lubricants.
" I.—Waste, &c.
" J.—Belting.
" K.—Rubber and Asbestos.
" L.—Engineers' Stores, Sundries.

N.B.—Tenders must be complete for all items in any one Section.

Persons tendering must give the names and addresses of two substantial householders as their sureties prepared to join them in the execution of the contract, and must attend the meeting of the Council at the time above named, and be prepared to deposit a £10 note in respect of each Tender accepted as a guarantee of good faith until the execution of the contracts. They must also make a declaration that they do and will, during the continuance of any Contract they may enter into with the Council, continue to pay the trades union rates of wages as agreed to by the employers' associations and the trades unions and as in practice obtain, or where there is no employers' association or trade union such rate of wages as prevails in the particular trade, and observe the conditions and hours of labour prevalent among the several classes of labour they may employ; and they must also agree not to sublet or assign over their Contract (or any part thereof) without the written consent of the Council previously obtained.

Forms of Tender and Contract and other particulars may be obtained on application at the Town Hall, Upper Street, N., on and after Monday, the 13th February, 1905, between the hours of 9 a.m. and 5 p.m. (except Saturday).

Tenders (properly endorsed) must be received not later than noon on Thursday, the 23rd February, 1905.

The Council does not bind itself to accept the lowest or any Tender.

By order, WM. F. DEWEY,
Town Hall, Upper Street, N., February 8th, 1905. Town Clerk.

WIMBLEDON URBAN DISTRICT COUNCIL.

ELECTRICITY DEPARTMENT.

The above Council is prepared to receive TENDERS for the supply of the Articles enumerated below during the year ending March 31st, 1906 :—

3. Engine-room Stores.
4. Cables.
5. Joint-Boxes and Jointing Materials.
6. Transformers.
7. Meters.
8. Oils.
9. Incandescent Electric Lamps, Carbons, and Accessories.
10. Iron Castings.

Forms of Tender and Specifications, with Conditions of Contract, may be obtained at the Office of the Electrical Engineer, Durnsford Road, Wimbledon, where Samples may be inspected.

Sealed Tenders, endorsed "Tender for———," are to be addressed to the Chairman of the General Purposes Committee, and delivered at my Office, 12, Queen's Road, Wimbledon, before noon on Saturday, the 4th day of March, 1905.

R. H. S. BUTTERWORTH, Clerk to the Council.
Council Offices, Wimbledon, February 7th, 1905.

METROPOLITAN BOROUGH of STOKE NEWINGTON.

ELECTRIC LIGHTING.

The Council of the Metropolitan Borough of Stoke Newington are prepared to receive TENDERS for the Supply, Delivery, and Erection of the following Sub-station Plant and Mains :—

Section 1.—TRANSFORMERS, THREE-PHASE MOTOR-GENERATORS, BOOSTERS, &c.
Section 2.—Extra H.T. and three-wire L.T. SWITCHBOARDS.
Section 3.—STORAGE BATTERY.
Section 4.—L.T. DISTRIBUTION MAINS.

Contractors may tender for one or more of the above sections, but not for part of a section.

Specifications and plans may be seen at the Offices of the Engineers, Messrs. TALBOT AND STEVENSON, 26, Victoria Street, London, S.W., but copies of these with general conditions and form of Tender may be obtained only at the offices of W. F. LOVEDAY, Esq., Borough Surveyor, Town Hall, Milton Road, Stoke Newington, N., on or after the 6th day of February, on deposit of cheque value One Guinea for each section, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders endorsed "Section———, Electric Lighting," are to be addressed to the Electric Lighting Committee, and must be delivered at the Town Hall, Milton Road, Stoke Newington, N., at or before 4 o'clock p.m. on Wednesday, the 8th day of March, 1905.

By order, GEORGE WEBB, Town Clerk.

APPOINTMENTS OPEN.

COUNTY OF LONDON.—THE LONDON COUNTY COUNCIL

COUNCIL are prepared to receive APPLICATIONS from persons, fully experienced in estimating London Building Works and in Measuring Variations on Contracts, for the POSITION of SURVEYING and ESTIMATING ASSISTANT in the Works Department of the Council.

Candidates must be not more than 45 years of age.

If an appointment be made, the salary proposed to be paid is £300 per annum.

Forms of application can be obtained by sending a stamped addressed foolscap envelope to "The Manager of Works, London County Council Works Department, Belvedere Road, Lambeth, S.E.," and the latest time for receiving applications is 10 a.m. on Friday, February 24th, 1905.

Personal canvassing of members of the Council is strictly prohibited.

G. L. GOMME,
Clerk to the Council.

The County Hall, Spring Gardens, S.W.,
February 8th, 1905.

CITY OF LEEDS.—THE CORPORATION

require the services of a fully qualified and experienced WATERWORKS ENGINEER, with special experience in the construction of waterworks, to take the supervision and management of the construction of new reservoirs in the Burn and Laver Valleys in Yorkshire, and also of the existing waterworks system of the Corporation. Salary, £1,000 per annum.

Applications, with three copies of testimonials, and endorsed "Water Engineer Application," to be sent to the undersigned not later than February 28th, 1905.

Canvassing members of the Corporation, directly or indirectly, is prohibited.

ROBERT E. FOX,
Town Clerk.

CITY AND GUILDS CENTRAL TECHNICAL COLLEGE, EXHIBITION ROAD.

CIVIL AND MECHANICAL ENGINEERING DEPARTMENT.

An ASSISTANT is REQUIRED who can teach Mechanical Drawing and Mechanism. Applicants should have had some experience in the drawing-office of a mechanical engineering firm. Apply, sending testimonials, with a statement of age and particulars of teaching experience, to Prof. W. E. DALBY. Salary £150 per annum.

MATHEMATICAL DEPARTMENT.

An ASSISTANT is REQUIRED immediately who possesses a sound knowledge of Elementary Mathematics and of the Elements of the Differential and Integral Calculus. Some experience in a mechanical or a physical laboratory and some knowledge of geometrical drawing is desirable, but not necessary. Salary £100 per annum. Apply sending testimonials and a statement of age, to Professor O. HENRICI.

COUNTY OF LONDON.

THE LONDON COUNTY COUNCIL requires the

SERVICES OF AN ENGINEERING ASSISTANT,

not over 45 years of age, who is a Member or Associate Member of the Institution of Civil Engineers, and who has had considerable experience both in the design and construction of engineering works. Preference will be given to a candidate who has had experience of large city improvement works and parliamentary procedure, and has had charge of a numerous drawing office staff. The salary attached to the appointment will be £500 a year, and the gentleman appointed will hold his office during the pleasure of the Council, will be required to give his whole time to the duties of his office, and will not be allowed to take any private practice, to hold any other appointment, or to occupy any other paid position, and any fees received by him either as a witness or in any other capacity are to be paid to the Council; and will further be required to conform to the Council's regulations in respect of the superannuation and provident fund, in the benefits of which he will participate.

Forms of application can be obtained either by applying personally or by sending a stamped addressed foolscap envelope to the "Clerk of the London County Council, Spring Gardens, S.W.," and the latest time for receiving applications is Ten a.m. on Monday, February 20th, 1905. Any application which fails to comply with the terms of this advertisement will not be laid before the Council. Personal canvassing of members of the Council is strictly prohibited.

G. L. GOMME,
Clerk of the London County Council.

The County Hall, Spring Gardens, S.W.,
January 31st, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 43, 45, 46, and 48.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros., Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

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Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
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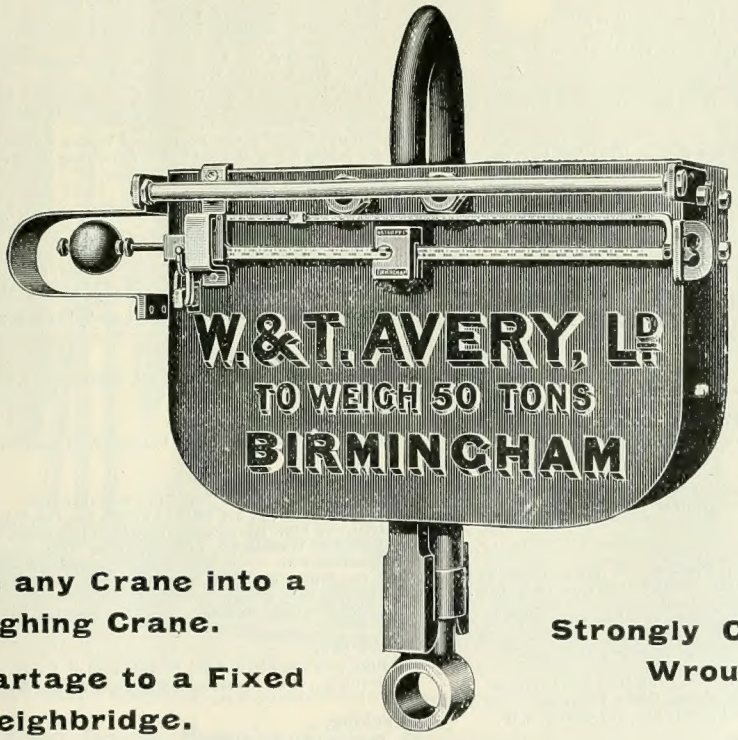

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Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

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Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gauges.
Klinger, Richard & Co., 66, Fenchurch Street, London, E.C.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Jointing Materials.
Richard Klinger & Co., 66, Fenchurch Street, London, E.C.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax
Northern Engineering Co, (1900) Ltd., King Cross, near Halifax.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
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Luke & Spencer, Ltd., Broadheath, Manchester.
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C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Whitman & Barnes Manufacturing Co., 149, Queen Victoria Street, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B, J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

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Photo Copying Frames.
J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.
Booker & Sullivan, 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.
Marion & Co., Ltd., 22, 23 Soho Square, London, W.

Pinch Bars.
Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.
Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

Rails.
Wm. Firth, Ltd., Leeds.

Railway Wagons.
Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).
Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd. Cambridge.

Stampings.
Thos. Smith's Stamping Works, Ltd., Coventry.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.

Stamps (Rubber).
Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.
British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.
Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.
Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.
Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.
S. Pegg & Son, Alexander Street, Leicester.

Superheaters.
A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.
Howard Bros., 10, St. George's Crescent, Liverpool, and 100c, Queen Victoria Street, London, E.C.
International Time Recording Co., 171, Queen Victoria Street, London, E.C.

Tubes.
Premier Boiler Tubes, Ltd., 28, Victoria Street, London S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.
G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.
Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.
Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.
Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.
Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.
Lassen & Hjort, 52, Queen Victoria Street London, E.C.

Weighing Apparatus.
W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.
A. C. Wells & Co., 100A Midland Road, St. Pancras London, N.W.

Wind and Water Supply Machinery.
Eric S. A. Smith, Bridlington.

Wire Working Machinery.
Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."
"Woodite" Company, Mitcham, Surrey.

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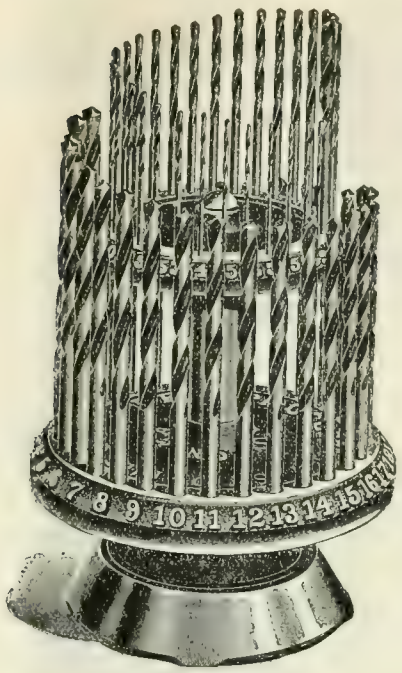

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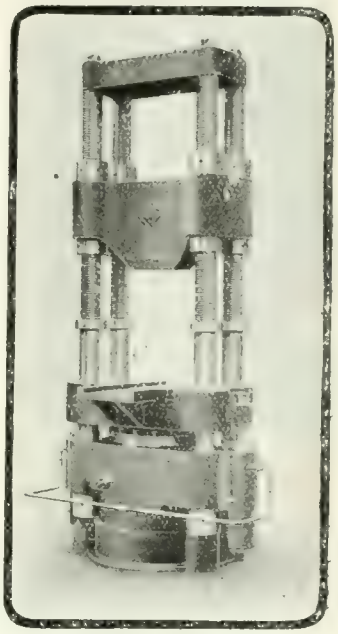

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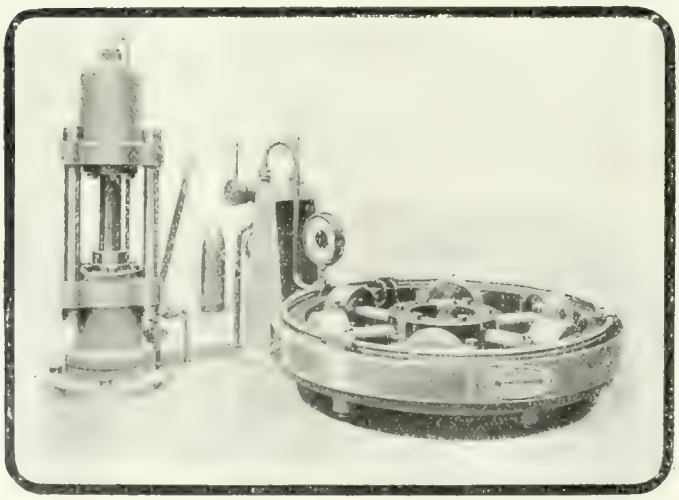

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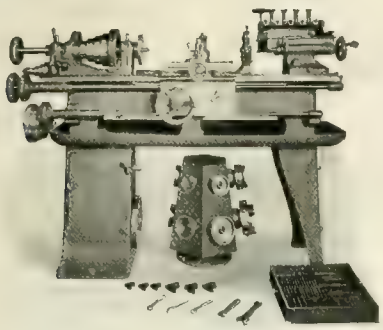

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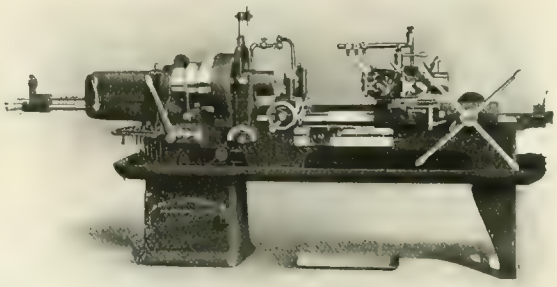

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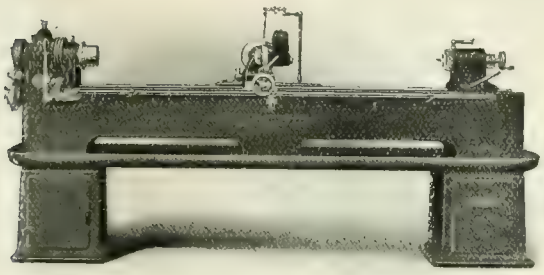

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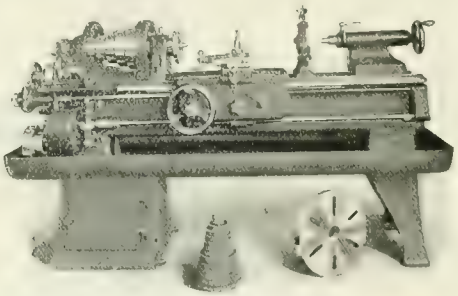

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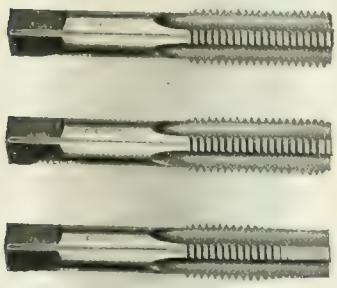

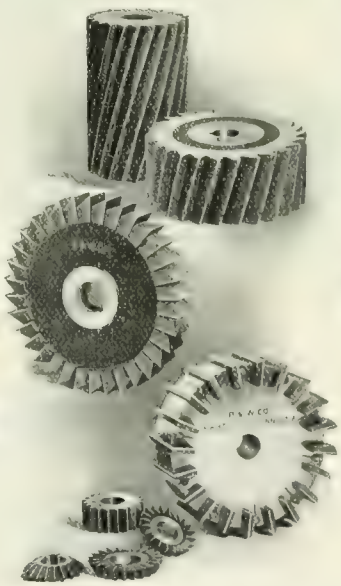

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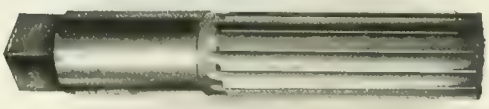


REAMERS. Our eccentric ground reamers give a smooth glass surface and will not chatter because the cutting edge is supported.

Send for New Small Tool Catalogue.

PRATT & WHITNEY Co.,

HARTFORD, CONN., U.S.A.

AGENTS:

NILES-BEMENT-POND Co., 23-25, Victoria Street, London, S.W.
BUCK & HICKMAN, Ltd., 2 & 4, Whitechapel Road, London, E.C.

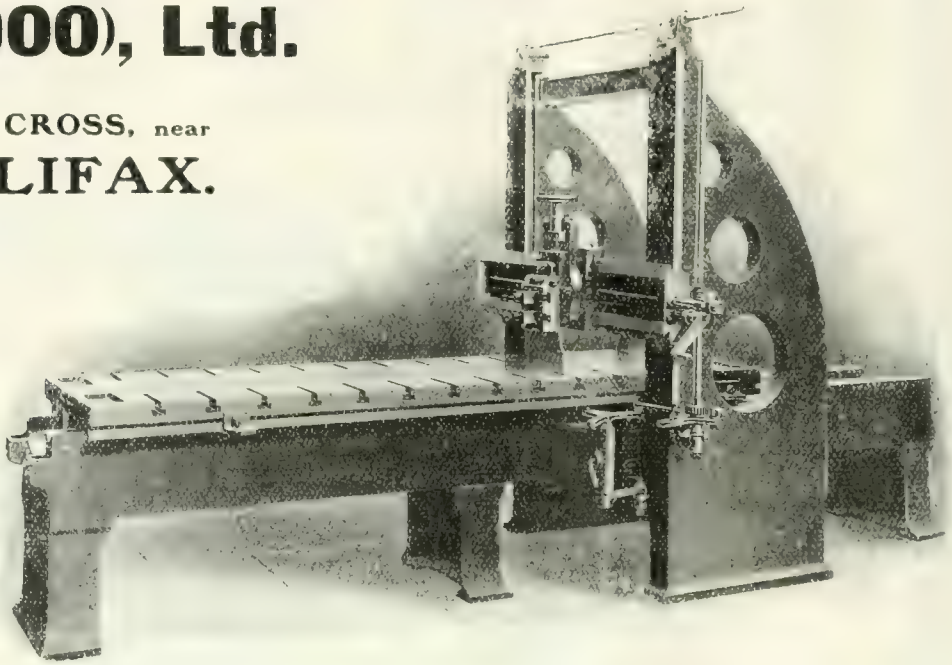
COPENHAGEN, DENMARK: V. LOWENER. STOCKHOLM, SWEDEN: AKTIEBOLAGET V. LOWENER. PARIS: FENWICK FREERES CO., 7, Rue de Rocroy. Agents for France, Belgium and Switzerland

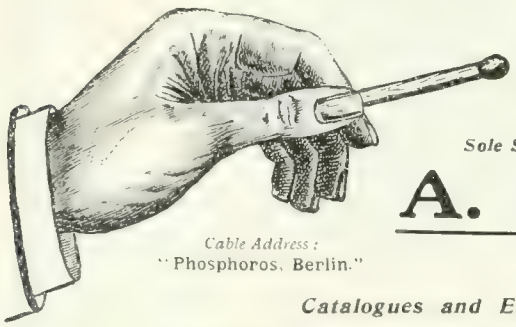
PAGE'S WEEKLY — Machine Tools

Northern Engineering Co. (1900), Ltd.

KING CROSS, near
HALIFAX.

PLANING MACHINE, from 2 feet up to 8 feet square.





Match & Match Box MACHINERY.

Sole Speciality since establishment in 1855 of

A. ROLLER, Engineer,

BERLIN N.20, GERMANY.

Cable Address: "Phosphoros, Berlin."

Catalogues and Estimates for Complete Plants Free on Application.

REFERENCES TO MATCH MANUFACTURERS ALL OVER THE WORLD.

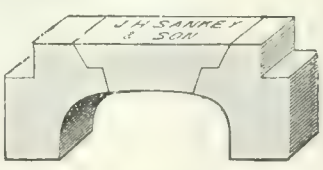
Sankey's Fire Bricks and Fire Cements.

Every Description of FIRE-CLAY GOODS. STOCK UNEQUALLED.

VARIOUS BRANDS

Engineers' Designs made to Order of the best Fire-resisting Materials.

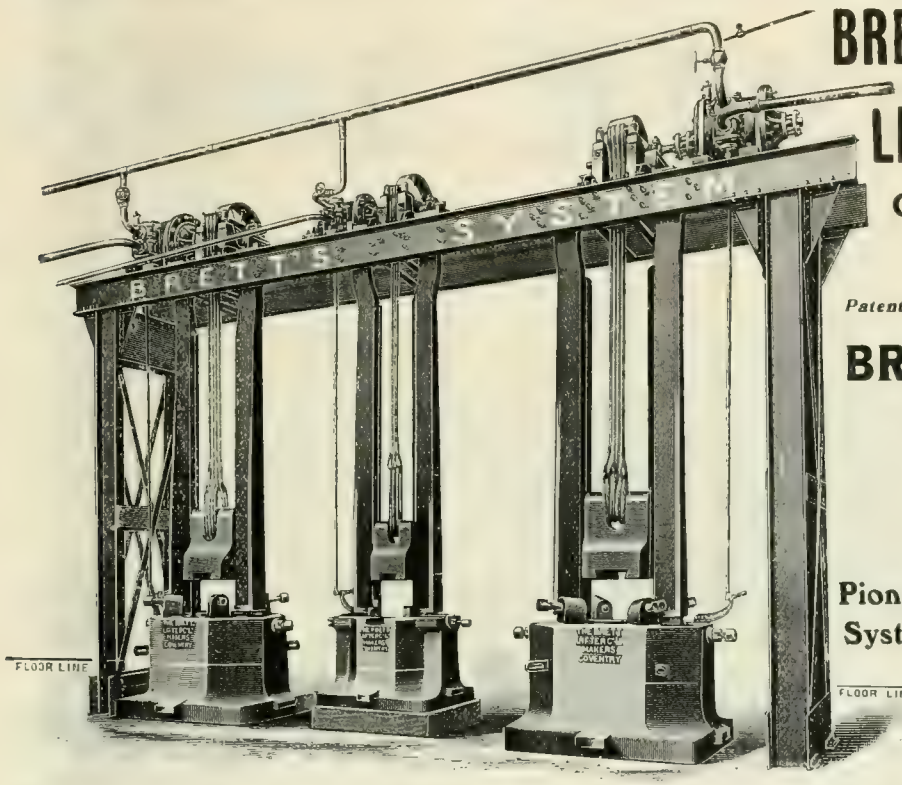
WRITE FOR NEW CATALOGUE.



J. H. SANKEY & SON, Ltd., Head Office, Essex Wharf, CANNING TOWN, E.

ESTABLISHED 1857.

PAGE'S WEEKLY — Machine Tools



BRETT'S PATENT LIFTER Co. Ltd.,

Coventry, England.

Patentees and Manufacturers of

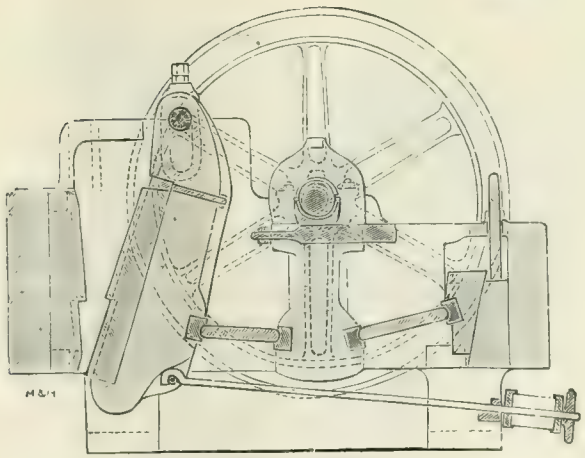
BRETT'S PATENT LIFTERS ETC.

Pioneers of the Modern System of Drop Forging.

Telegraphic Address :
"LIFTER, COVENTRY."
Telephone No. : 384.

STONE BREAKERS.

(Improved Blake Type.)



Section of Machine.

Rollers,

Screens,

Gravel Washers,

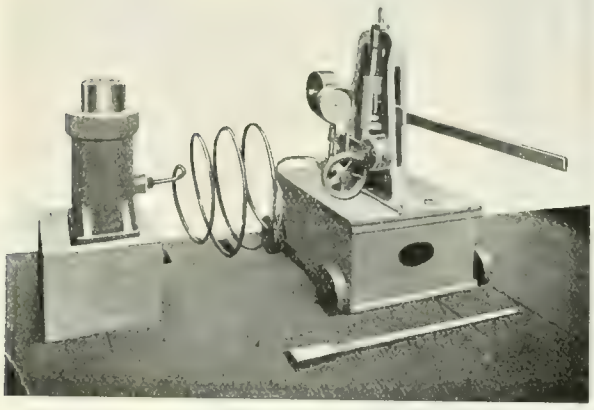
Concrete Mixers.

SAMUEL PEGG & SON,

National Telephone 104. **Alexander Street, LEICESTER, ENGLAND**

PAGE'S WEEKLY — Machine Tools

HYDRAULIC TOOLS.



BOILER FLUE APPARATUS.

This illustration shows an apparatus for pushing up boiler flues. The cylinder and ram can be got into a flue of 24 in. diameter, and is capable of dealing with plates up to ¾ in. of thickness cold.

Prices and Particulars on Application.

Telegraphic Address: "PRESS, LEEDS."
A.B.C. Code, 4th Edition, used.
National Telephone: 2362.

RICE & CO.

(Leeds), Ltd.,

ELLAND RD., LEEDS.

If you have a friend abroad,

send us his name and address, together with your own—a postcard will do—and we will mail him free a copy of the next issue of PAGE'S WEEKLY.

It would please him still more

if you subscribed at once for a copy to be sent to him each week for a half-year (8s. 4d.), or a whole year (16s.). We would advise him of your subscription, and post the copies regularly in time for the Saturday foreign mails.

Address: The PUBLISHER (Foreign Circulation), PAGE'S WEEKLY, Clun House, Surrey Street, Strand, London, W.C.

Telegrams: "MILLING, SHEFFIELD."
National Telephone No.: 985.

For the Latest and most Up-to-Date

HEAVY MACHINE TOOLS

PLATE BENDING MACHINE.

Also Special Lifting Jack for Electric Tramcars.

WRITE . . .

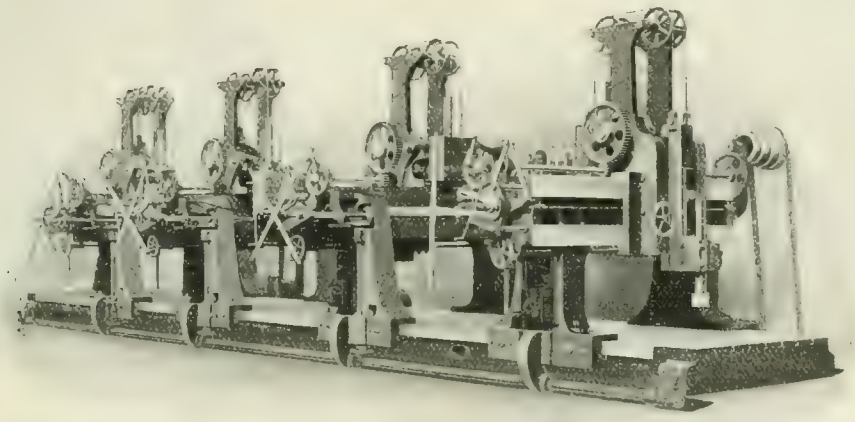
GEORGE ADDY & Co.,
WAVERLEY WORKS, SHEFFIELD.

PAGE'S WEEKLY — Machine Tools

JOHN STIRK & SONS,

MACHINE TOOL MAKERS,

(Established 1866.) **HALIFAX.**



Locomotive Frame-plate Slotting Machine (85 tons).

Boltons' Downtake Superheater

WITH DOUBLE CIRCULATION.

IMPROVED BOX AND "FIELD" TUBES. (PATENTED.)

Simple and Reliable. Readily Applied. Inexpensive.

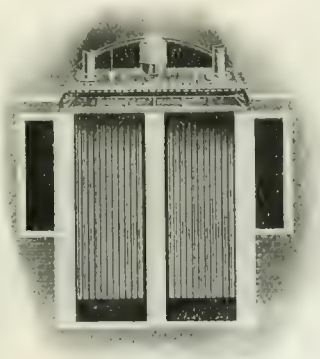
Saves 10 to 15 %

Is made of Steel throughout.

A large number working in—
Textile Mills,
Paper Works,
Collieries,
Electricity Stations,
Flour Mills, etc.

Suitable for any Working Pressure up to 200 lbs. per square inch.

Approved of by Leading Engineers and Insurance Co.'s.



REPEAT ORDERS BEING GIVEN.

PATENTEES AND SOLE MAKERS:—

A. BOLTON & CO.,

Engineers and Superheating Specialists,

49, Deansgate, MANCHESTER.

"ABOUT VISES."

A BOOKLET (FOR THE ASKING)

By the
Makers of the

"PERFECT" VISE.

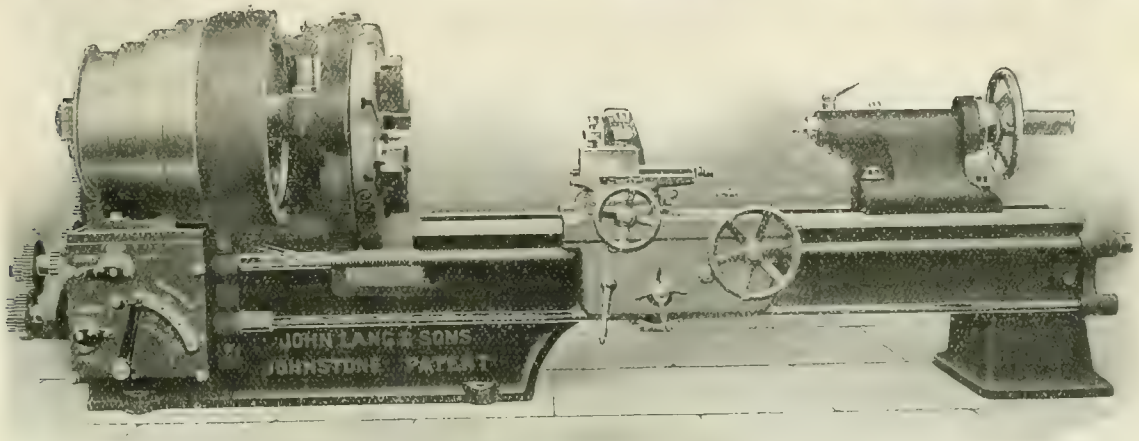
J. PARKINSON & SON,

SHIPLEY, ENGLAND.

Cables: "TEMPLES, SHIPLEY."
Code: A B C 5th Edition.

PAGE'S WEEKLY — Machine Tools

LANG'S HIGH-SPEED LATHES



Have Patent Bed, Patent Loose Head, Patent Screw-Cutting and Feed Motions, also Enormous Power combined with Convenience of Manipulation.

JOHN LANG & SONS, Johnstone, near Glasgow.

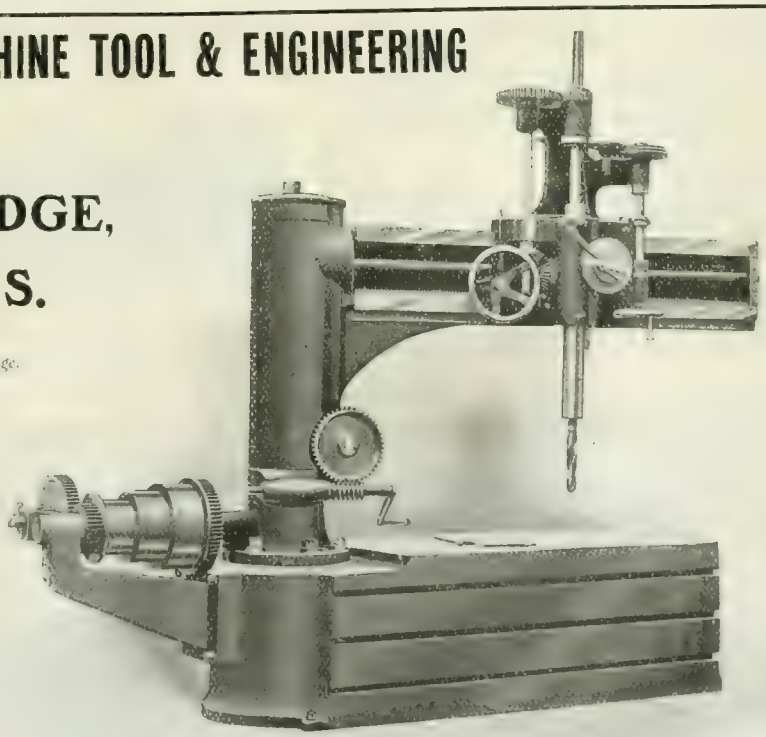
YORKSHIRE MACHINE TOOL & ENGINEERING WORKS,

LIVERSEDGE,

Nr. LEEDS.

Telegraphic Address: "Alma, Liversedge.
Nat. Tel.: 58 Heckmondwike.

Designers and Builders of High-Class Machine Tools.



6 ft. arm High Speed Radial Drill. Capacity, six ¾ holes through 1 in. plates per minute. 600 revolutions on drill. No belt feed.

PAGE'S WEEKLY — Machine Tools

BATEMAN'S MACHINE TOOL Co., LTD.,

Makers of . . .

HIGH-SPEED PLANERS ONLY

Address: **Hunslet, LEEDS.**

OUR PATENT MACHINES

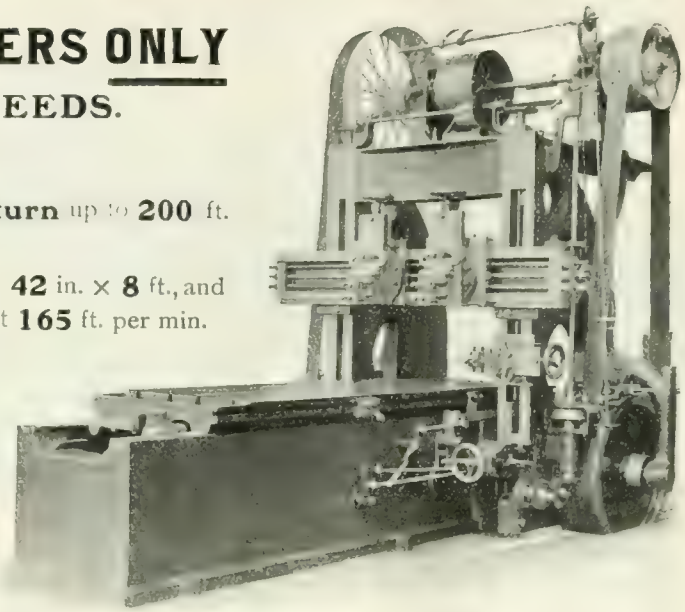
Cut up to **80** ft. per min. and **Return** up to **200** ft. per min. according to size.

The Machine illustrated is a **42** in. × **42** in. × **8** ft., and **Cuts** at **60** ft. per min., **Returns** at **165** ft. per min.

With Two Tools at $\frac{1}{8}$ in. feed, it will plane **4,032** sq. in. in **30** to **35** mins.

With a cut $\frac{3}{8}$ in. deep, at $\frac{1}{8}$ in. feed, it will remove nearly **½-TON** of metal per **hour.**

Our **60** in. × **60** in. × **12** ft. Planer **Cuts** at **60** ft. per min., **Returns** at **130** ft. per min.



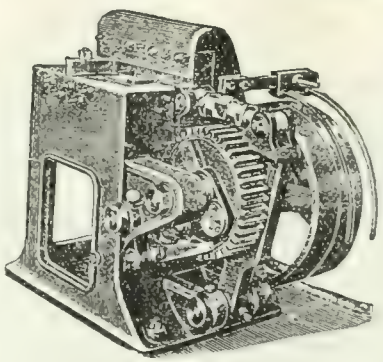
42 in. × 42 in. × 8 ft. PATENT HIGH-SPEED PLANER.

C.W. Hasenclever Söhne DÜSSELDORF.

Special Machinery

FOR MAKING

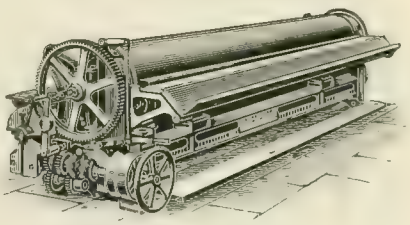
Bolts, Nuts, Rivets,
Insulator Brackets,
Horse-Shoes,
Horse-Shoe Nails,
Calkins, and
Similar Forgings.

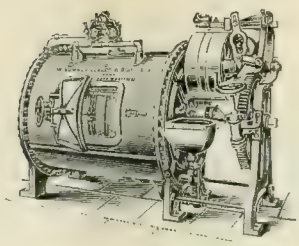


ROLLING MACHINE FOR IRON SCREW THREAD.

PAGE'S WEEKLY — Machine Tools

Laundry Machinery AND COOKING APPARATUS.





W. Summerscales & Sons, Ltd.

CATALOGUE ON APPLICATION.

Phœnix Foundry, KEIGHLEY, ENGLAND.

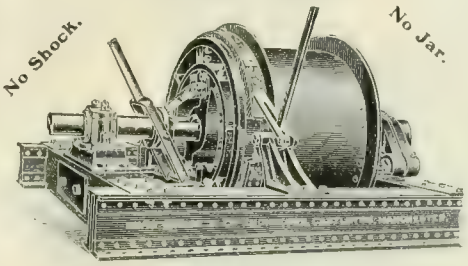
HEYWOOD & BRIDGE'S PATENT FRICTION CLUTCH and SHAFT COUPLING.

WE MAKE
CLUTCHES,
SHAFTING,
GEARING and
HAULING
INSTALLATIONS
A SPECIALITY.

Sixty Page Work—Free.
DON'T MISS THIIS

Prevents Accidents.

No Shock. No Jar.



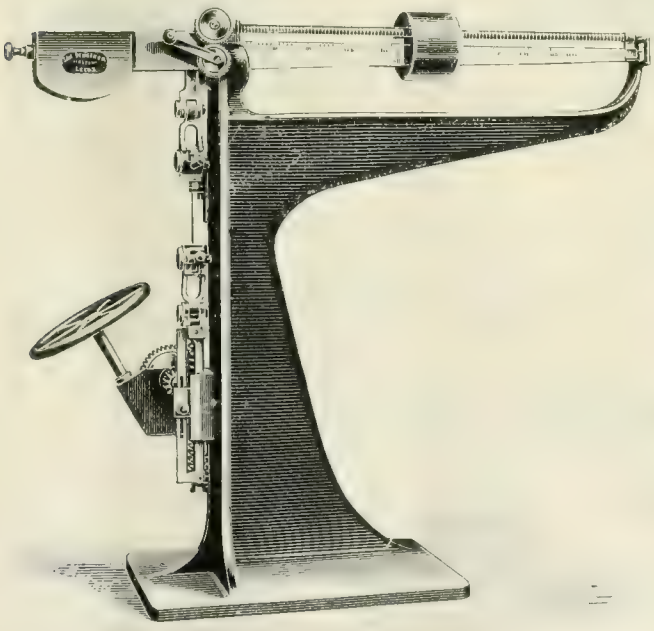
Hauling Made Reliable.

Patentees and Sole Makers:

DAVID BRIDGE & CO.,
Castleton Iron Works,
ROCHDALE, LANCS.

London Office
35, Queen Victoria Street,
E.C.

Denison's SINGLE LEVER Wire Tester.



This apparatus is arranged for ascertaining the tensile strength of small wire, and is very accurate.

NO LOOSE WEIGHTS.
ACCURATE EXTENSION GAUGE.

Capacity	1,000 lbs. avoir.	(1)
..	1,250	(2)
..	1,500	(3)

The 'poise weight carries a vernier to show single pounds.

RAPID IN USE.

PATTERN B.

SAML. DENISON & SON, LTD.,

Hunslet Moor,

Telegrams:
"WEIGH, LEEDS."

Near LEEDS.

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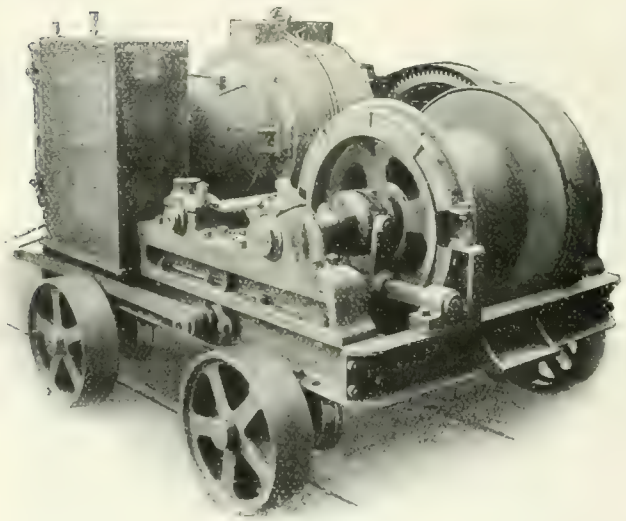
ELECTRIC HOISTING and HAULING GEARS.

Send us Particulars of your requirements, or sketch of your workings, when we will submit to you the most Economical Method and our Lowest Prices.



The above shows a 20 B.H.P. Portable Electric Winch arranged to run on road or rails.

SPECIALITIES.

Our Specialities are:—

Secondary Haulage,

Electrically Driven Three-throw Pumps,

Main and Tail, Main Rope, Endless Rope, and Portable Hoisting and Hauling Gears.

M. B. WILD & CO., Mechanical and Electrical Engineers.

Head Offices:—

35 & 36, Clarence Chambers,

CORPORATION STREET, **BIRMINGHAM.**

Works: NECHELLS. BIRMINGHAM.

Telephone No: 4608.

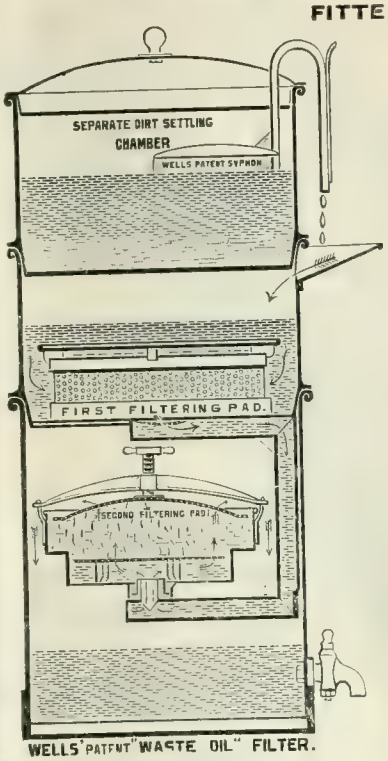
Telegrams: "HAULING, BIRMINGHAM."

PAGE'S WEEKLY

Wells' Specialities

WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.



WELLS' PATENT "WASTE OIL" FILTER.

SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.

OVER *10,000* SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.—For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in.	35/-
No. 2.—Two top chambers hold about 3 gallons oil, 22 in. by 10 in. ..	50/-
No. 3.—Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ...	70/-
No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ...	110/-
No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ...	189/-
No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

Capable of dealing with **250** Galls. Oil per week

LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6.	Handy Size. No Tank. On Wheels.	£7 7s.
No. 4.	Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals.	£8 10s.
No. 4A.	Price, with Wheels. 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

Price 13/8 per cwt.,

Carriage Paid in England and Wales, (If in lots of 3 cwt. at a time, 12/8 per cwt.)

A. C. WELLS & Co.,

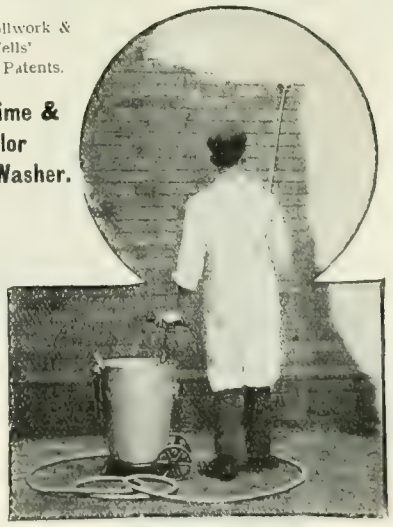
100a, Midland Road, St. Pancras,

Works: Cheetham, Manchester. LONDON, N.W.

WELLS' "LIGHTNING"

Wallwork & Wells' Patents.

Lime & Color Washer.



No. 4a, with Wheels.

PAGE'S WEEKLY

Tubes, &c.

PAGE'S WEEKLY — Aerial Ropeways

ILLUSTRATED PAMPHLETS MAY BE HAD ON APPLICATION.

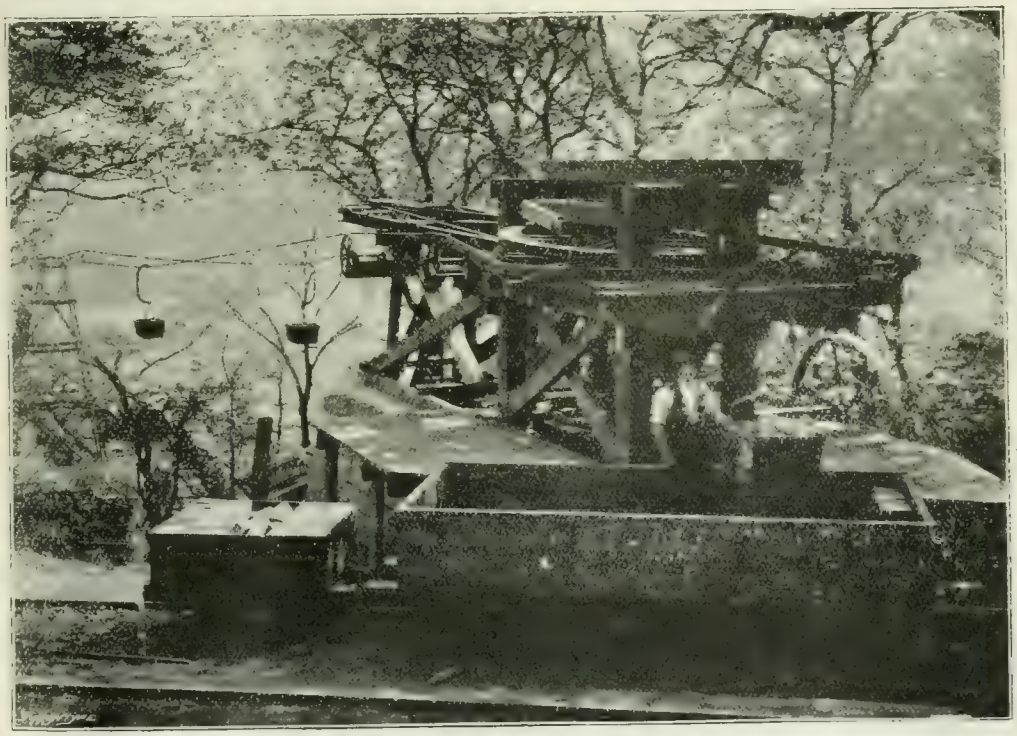
AËRIAL ROPEWAYS

AND INCLINES ON ALL SYSTEMS

CONSTRUCTED BY

BULLIVANT & CO., LTD.

EXAMPLES AT WORK ALL OVER THE WORLD.



Ropeway constructed for the Newcastle and Gateshead Waterworks, Wylam-on-Tyne.

Ropeways constructed to convey from 50 to 2,000 tons per day. Suitable for the transport of all descriptions of materials.

Makers of

Flexible Steel Wire Ropes for Cranes, Lifts, Hoists, etc.

Regd. Office: 72, Mark Lane, E.C. Works: Millwall, E.

Telephone 2110 Avenue **LONDON.**

Temperley Transporters.

Telegraphic Address:
"TRANSUMO, LONDON."

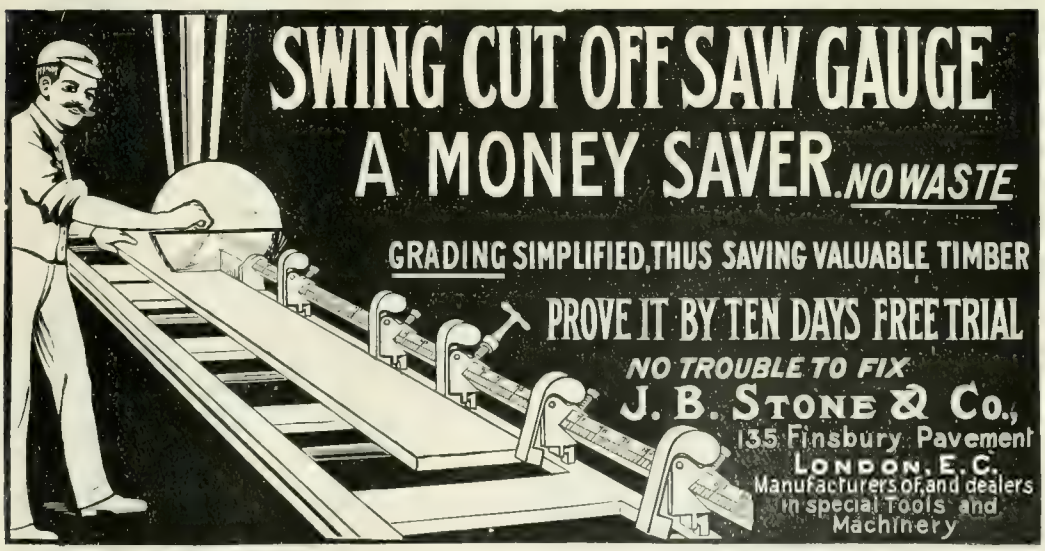
Telephone No:
365 LONDON WALL.

Temperley Patent Fixed Transporter and Travelling Tower Transporter working in conjunction at West Middlesex Water Works, unloading coal and distributing over storage ground. Load, 35 cwt.

For Rapid and Economical Handling of General Cargo, Coal, Ore, &c.

TEMPERLEY TRANSPORTER COMPANY,

72, Bishopsgate Street Within, London, E.C.



PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY — Miscellaneous

PAGE'S WEEKLY

Miscellaneous

Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY — Miscellaneous

Index to Advertisers—(Contd.)

Index to Advertisers—(Contd.)

PAGE'S WEEKLY — Miscellaneous

Index to Advertisers—(Cont.)

MAGNOLIA METAL..

Best Anti-Friction Metal for all Machinery Bearings.

"Flower" Brand.

"Flower" Brand.

The Name and Trade Mark appear on each Box and Ingot.

Magnolia Anti-Friction Metal Company, of Great Britain, Limited,

49, QUEEN VICTORIA STREET,
LONDON, E.C.

Telephone: 5925 Bank. Telegrams: "MAGNOLIER, LONDON."

BERLIN: FRIEDRICH STRASSE, 71. PARIS: 50, RUE TAITBOUT.
LIEGE, BELGIUM: 36, RUE DE L'UNIVERSITE.
GENOA, VIA SOTTORIPA: 1, PIANO NOBILE.

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, FEBRUARY 17, 1905. No. 23.

The Offices of "Page's Weekly," Wednesday, Midnight.

WE shall await with considerable interest the "proposals for improving the status of the Local Government Board and the Board of Trade and for establishing a Ministry of Commerce and Industry" as foreshadowed in the speech from the throne on Tuesday. We cannot agree with Earl Spencer that the proposed measure is a "very curious one" in view of the mischief which has been done in the past by hampering trade legislation, and the question of the noble earl "Is the Board of Trade to be *entirely suppressed* or converted into a new department?" seems a little superfluous in view of the expression "improving the status" of the bodies in question. The proposal is one which it is to be hoped will not be shelved. The appointment of a Minister of Commerce should be one of historic importance to the British Empire.

In the United States the President of Commerce and Labour is expected to foster and promote the foreign and domestic commerce of America, and call upon Consular representatives abroad to furnish reports on markets for American products. The French Ministry of Commerce and Industry performs similar service for France in pushing French commercial interests abroad. Austria, too, finds it worth while to appoint a Minister of Commerce. It is surely quite time that something is done to bring about a closer relationship between the commercial community and our own Government.

Mr. Lewis Nixon, President of the United States Shipbuilding Trust, has been asking himself and the readers of a magazine published in New York, whether gas producers are to mark the end of the steam age. He appears to think that but for what he calls the "conservatism of the engineering world" in the pursuit of steam developments, to the comparative neglect of the gas engine, we might by this time have arrived at a satisfactory

A RECENT PORTRAIT OF MR. MARCONI.
Whose forthcoming marriage is dealt with on page 370.

by courtesy of the Royal United Service Institution.]

THE NEW FRENCH FIRST-CLASS ARMOURED CRUISER "CONDE"; 10,000 TONS; 20,500-I.H.P.; SPEED, 21 KNOTS.

Armour Protection.—Water-line belt of 6-in. H.N.S., 6 ft. 6 in. deep, ending short way from stern in a 3·4-in. transverse bulkhead; an upper belt 5·5 in., reaching to main deck, tapering to 3·5 in. on bow, and 3-in. on stern; turrets, 5 in. with 2 in. ammunition hoists; casemates and secondary turrets 5 in.; conning tower, 8-in.; protective deck, 1·7 in.; splinter deck, 1·4 in.

Armament.—Two 7·6-in. quick-firers in turrets, one forward and one aft; four 6·4-in. quick-firers in casements and four in turrets on upper deck; six 3·9-in. with shields, eighteen 3-pounder and six 1-pounder guns, with five torpedo tubes, two submerged, two armoured above water, and one unarmoured at stern.

flying machine. Mr. Nixon cuts into a theme dear to the heart of Mr. B. H. Thwaite, when he says: "Can we predict the trend of development? I think the great strides made lately in the use of producer gas, and the distribution of coal through the ports of the world, will result in the use of producer gas plants on board vessels of larger size with engines using gas made by such plants." The producers, he continues, can be erected in less space than boilers, and it is already known that the gas engine can be produced of any size. We can proceed along lines already proved, and cut our coal bill in half. The greatest problem before the ship designer is how to handle the boiler. The production of power by steam engine gets us back at once to the man-fired boiler. We must have air and space in which to shovel, fire rooms whose size will prevent prostration from heat, and bunkers much larger than should be necessary, on account of the waste of coal. When we get our boiler space arranged, after obtaining every concession that can be squeezed out of all other factors, we proceed to build a vessel around it.

Mr. Nixon is enthusiastic about the proposed use of gasoline engines in war vessels. He says, for instance, that in torpedo-boats there is a decided advantage in the use of petroleum or gasoline. In a torpedo-boat developing 3,200 h.p. under forced draft, we would most certainly burn not less than three pounds of coal per i.h.p. per hour, or say for ten hours we would use at the least calculation ninety-six thousand pounds. We can develop a b.h.p. on a gallon of gasoline for ten hours, or we would use 3,200 gallons of fuel in the ten hours. In other words, we can increase the radius of action of such a vessel more than three times on the same weight of fuel. This assumes that a steam torpedo-boat can be run at full speed for ten hours under trial conditions. To get ready to force the steam-driven boat, we must take at least two hours coddling the boilers; during the run we must clean them, with consequent loss of speed and waste of fuel; while the strain upon the men of a constant full-pressure run of ten hours would be practically unbearable. The gasoline engines require no long working up of steam pressure, but are ready to start at full speed in an instant. There is no strain upon the men in the engine room. Mr. Nixon further says it is perfectly feasible under present conditions to produce a ten-thousand-ton cruiser of twenty-one knots that could steam around the world at fourteen knots without taking on fuel and without sacrificing anything in war efficiency or fighting power.

The electric street lamp-posts designed specially for the City of Sydney must be something quite unique in their way, for in describing his first impressions of them, a member of the Electrical Association of New South Wales said they reminded him of "something between a giraffe and an ostrich. It seemed to him that if the design had to be zoological, the authorities should not have overlooked the kangaroo." This, of course, was so much banter. The erection of lamps for the City of Sydney involved quite exceptional difficulties, chiefly occasioned by its awnings and its telegraph wires. The former render side lighting difficult on account of the heavy shadows on the footways. The overhead tramwire and the narrowness of the street prohibit centre lighting almost entirely. In every street there are overhead telephone wires, and in many streets these are on both sides of the road. They are usually at a height of 18 ft. 6 in. above the footway. These conditions led to the adoption of a special post, having a very large overhang and placed on the kerb.

With the lighting plant generally, much satisfaction appears to be felt. The following, among other details, were given at a meeting

of the above Association by Mr. T. Rooke. The system decided upon was the generation of three-phase alternating current by steam power, and the transmission of the current at 5,000 volts to sub-stations, the conversion at two sub-stations to continuous currents for distribution on a three wire direct-current network, at 240 and 480 volts in the centre of the city, and the conversion at the other sub-stations by static transformers, for distribution on a four wire three-phase alternating current network at 240 and 415 volts, in the outlying portions of the city. Before adopting this system there were of necessity, many circumstances to take into account, and the advantages and disadvantages of many different methods of doing the same thing had to be considered. For public lighting it was decided to connect arc lamps in series across the distribu ors, ten open direct current lamps being provided on the 480 volts, and nine on the 415 volts alternating current.

The five boilers in the power house are of Messrs. Babcock and Wilcox well-known make, and constructed for a working pressure of 160 lb. per square inch. Each has a grate area of 58 square feet, and a heating surface of 3,240 square feet. The feed water pumps, says Mr. Rooke, are steam driven, although electrically driven feed pumps have become so fashionable of late. All other auxiliary machinery is electrically-driven, the absence of small steam mains, the quiet working, greater simplicity and the low maintenance cost being held to compensate for greater first cost.

The engines are of the vertical cross compound quick speed Ferranti type, which is chiefly remarkable for its valve gear. This is operated by cams contained in a box placed between the high-pressure and low-pressure cylinders, the whole of the gear being immersed in oil. The cams are operated from the crank shaft by bevel and helical gear; they are of uniform diameter and are therefore positive in their action, without resorting to springs. Variable cut-off is obtained by operating the valve rod from the centre of a yokepiece, connecting the bridles on two cams. One of these cams, that which admits steam, is fixed, the other cam, which cuts off steam, is movable, being fixed on a sleeve thread having a quick thread cut on its surface. The valves are placed in the cylinder heads, two steam and two exhaust valves being provided in each cylinder. The surface speed of the valve at 214 revolutions per minute, which is the speed of the 1,000 h.p. engine, is 22 ft. per minute. The electrical portion of the machinery consists of Dick Kerr three-phase generators producing current at an E.M.F. of 5,000 to 5,200 volts

REAR VIEW OF SHIELD USED FOR EXCAVATING THE UPPER HALF OF THE NEWLY-COMPLETED EAST BOSTON TUNNEL. (See page 570.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

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Clun House, Surrey Street, Strand, London, W.C.

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Editorial.—*All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

Any contributions offered, as likely to interest either home or foreign readers, dealing with the industries covered by the Weekly, should be accompanied by stamped and addressed envelope for the return of the MSS. if rejected. When payment is desired this fact should be stated, and the full name and address of the writer should appear on the MSS.

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

NEWS ITEMS.

The Royal School of Mines.

Mr. T. Arthur Richard, presiding at the 32nd annual dinner of the old students of the Royal School of Mines, claimed that mining has done for our modern world what Raleigh and Frobisher, Drake and Hawkins did in the stirring times of Queen Elizabeth. It has given the materials for modern civilisation, it has been the pioneer of territorial expansion, and has found new worlds to redress the balance of the old. In the course of subsequent remarks, he said that the day for drifting and blundering had gone, the logical method of science was being applied to the direction of human affairs; and if they confessed with shame the better assistance given to the preparation of those who directed the business and technology of mining in countries other than our own, if they recognised the disregard for the well-being of an industry to which this nation owed so much, and if they saw that mines and melters owned by Englishmen were officered by their American and German friends, they were not to be jealous save in honourable rivalry, but say, as forcibly as they could, that it was high time for England to give her mining sons the preparation which she gave to her sailors and soldiers—in other words, there was need of a National School of Mines. The following memorial was signed at the dinner, and subsequently forwarded to the secretary of the Departmental Commission inquiring into the organisation of the Royal School of Mines: "Sir,—We, the undersigned associates and old students of the Royal School of Mines, all of whom have had practical experience in connection with mining and metallurgical industries, beg you to convey to the members of your committee our conviction that the following conditions are essential to the future efficiency of the school: (1) That the title be retained as 'The Royal School of Mines'; (2) that the diploma of 'Associate of the Royal School of Mines' be retained as heretofore; (3) that the School, even though it may be affiliated to some central institution, be preserved as a separate entity, as regards mining and metallurgical training, with its own special staff and organisation. We believe that these are the opinions of every associate and old student of the Royal School of Mines, and we beg to ask your committee to give its very serious consideration to the above points."

The exports of the Transvaal for the year 1904 amounted in value to £17,770,988, as compared with £12,000,012 for 1903.

THE JUNIOR INSTITUTION OF ENGINEERS.

COMING OF AGE DINNER.

Photo by Fradelle and Young.]

MR. W. H. LINDLEY, M.INST.C.E., F.G.S. (PRESIDENT) IN THE CHAIR.

At the head table (A), reading from left to right, will be seen Mr. H. J. Young, Mr. F. C. Cousins, Mr. J. B. Batchelor, Mr. S. H. Wells, Mr. C. de G. Sells, Professor H. E. Armstrong, Mr. J. P. Waldram, Mr. A. Siemens, Professor J. A. Ewing, Mr. J. H. Balfour Browne, Lord Reay, Mr. W. H. Lindley (President), Venerable Archdeacon W. M. Sinclair, Mr. James Swinburne, Dr. R. T. Glazebrook, Professor W. E. Ayrton, Mr. C. Hawksley, Mr. D. Irving, Mr. S. Cutler, Mr. T. E. Gatehouse, Mr. W. Ballantyne, Mr. Harold Wade, Mr. W. J. Tennant, Mr. A. Ross, Mr. B. E. Dunbar Kilburn, W. T. Dunn, (Secretary), Col. H. R. Mead, Mr. J. W. Wilson.

At the other tables, reading from left to right of photo., are the following :—

Table (B): Messrs. H. N. Gray, R. H. Kenyon, F. Fraser, N. J. Ennor, E. Ketchell and G. Peyrecave.

Table (C): Messrs. E. A. Pettit, M. Isaacs, E. F. Corr, C. W. Pettit, J. A. Gardiner, I. W. Hunter, M. Rampal, F. C. Walker, W. P. Turner, A. Beck, E. Dickinson, J. Blackburn, J. W. Nisbet, F. H. Avent, A. Hoyle, J. Green, T. R. Jordan, J. Bailey, R. N. Tough, J. Shillinglaw, E. Sears, E. Grimwood and H. T. Gould.

Table (D): Messrs. C. H. Kilmister, H. W. A. Carter, E. J. Warner, F. Walker, J. S. Miller, W. Matthews, J. W. Sutton, J. S. Whatton, F. W. Dunn, H. Pywell, G. A. Miller, G. P. Miller, J. Ward, H. Cook, T. Beaton, J. Oswald, J. Brown, R. F. Mogridge, I. Newson, J. Boot, W. A. Dickson, and J. N. Boot.

Table (E): Messrs. G. Cutler, W. Cutler, W. Lavey, F. Cutler, C. Brantsen, F. R. Dunham, and S. Cutler, Junr. (Chairman). The other gentlemen at this table are press representatives.

Table (F): Messrs. A. W. Marshall, A. E. Nash, R. Marshall, J. Speakman, G. Woodrum, Wilkinson, W. Paterson, H. S. Chapman, G. H. Robus, F. King, H. E. Yarrow, B. H. Soulsby, H. Stevens, H. N. Stevens, F. P. Hughes, E. Hughes, Hedley Hughes, Harry Hughes, A. M. Hughes, C. E. Cole, R. Cooper, G. T. Bullock, and T. H. Rigg.

Table (G): Messrs. H. Capsey, A. E. Penn, V. E. Haertel, A. J. Mack, T. C. Cordock, J. G. Sneath, T. Gibbins, C. F. Hill, A. E. Mohring, F. C. Haste, A. Bazire, F. H. Wedge, G. Canning, D. N. Hunt, A. L. Ressich, J. Sneath, L. S. DeRitter, A. Burgess, F. L. Rowe, F. A. Sowerby, and W. H. DeRitter.

Table (H): Messrs. E. J. Mears, S. Osborne, H. T. Smith, H. J. Coventry, A. H. Stanley, E. C. Whitby, P. W. Palmer, P. Marshall, W. A. Tookey, R. Hunter, C. J. Treasure, G. Edwards, L. Eedy, B. T. King, F. Mitchell, E. Eade, A. O. Ayres and P. L. Young.

The Junior Institution of Engineers.

The coming of age dinner of the above society was held at the Hotel Cecil on Saturday last, under the presidency of Mr. W. H. Lindley, M.Inst.C.E., F.G.S. Among those present were Lord Reay, G.C.S.I., the Venerable Archdeacon W. M. Sinclair, D.D., Mr. J. H. Balfour Browne, K.C., Mr. James Swinburne, M.Inst.C.E., Professor J. A. Ewing, Dr. R. T. Glazebrook, Professor W. E. Ayrton, etc., etc.

The president, in giving "The City and Port of London," referred to the proposed dockisation of the Thames. He remarked that a dam would greatly limit the tidal column sweeping up and down the river, and it would be necessary to utilise artificial means for doing the work which the tide might be made to accomplish. He suggested that the method successfully adopted at Bremen, whereby the force of the tide was skilfully directed towards scouring the channel and otherwise maintaining the waterway in a state of efficiency, might be applied to the Thames.

Archdeacon Sinclair, in responding, acknowledged the immense indebtedness of the City to engineers, then appealed for consideration for St. Paul's when the engineers were preparing further burrowings for tube railways.

Lord Reay, in proposing the toast of the evening, congratulated the members on having built up in twenty-one years an association which took a foremost place among the institutions of the country. The engineering profession was one which inspired those outside with esteem and respect. In the engineering profession there was no opening for amateurs or quacks; an engineer who was not up to the work was soon found out. He spoke with great admiration of the engineering profession because of the experience he gained while Governor of Bombay. The five years he was in charge of the public works department had induced high admiration for the energy and ability displayed by the profession which had conferred the greatest benefits on India. Upon the railways the present prosperity of Indian trade rested; they were an important element in frontier defence, they enabled the Government to successfully grapple with famine. Only by great irrigation works had agriculture been made possible in Sind and elsewhere, and the success of drainage systems in the towns was evidenced in the health statistics. The future of the empire depended in many respects upon the skill they would display in carrying out their profession in the colonies.

The health of the Secretary, Mr. W. T. Dunn, was proposed by the President, and was accorded with musical honours.

New Departures in Railway Working.

Some very interesting remarks illustrating the effect of modern conditions upon suburban railway traffic were made at the 141st half-yearly meeting of the London and South-Western Railway Company, by the Chairman, Sir Charles Scotter. There had, he said, been several new departures in railway working in the past year. For the first time in railway history electric traction had been used on lines which had been constructed for steam traction, and the two systems of working had been simultaneously in operation on the same lines. It was impossible to state what might be the ultimate results of these experiments. Within probably, about three months, the railway belonging the the South-Western Company between Putney-bridge and Wimbledon would be worked by the District Company, all of whose trains would be carried over that section of the company's line, and also up to Richmond, by electrical traction. Another new feature had been largely developed during the past year in the shape of rail motor-cars. The South-Western and the Brighton Companies were the pioneers in regard to this mode of working. So far back as June, 1903, they began working a rail motor-car over the Southsea branch, which belonged to them jointly, between Fratton and Southsea; and he might state that the cost of working that branch has been very considerably reduced, while the traffic had slightly increased. Experiments of the same kind were being made in other directions. In fact they had the system in operation on the Botley and Bishop's Waltham branch of their line, and they intended to try it on those branches where the traffic was small. He was sure they would thus be enabled to give a better service to the public and at less cost to the company. As he had said, the Brighton and South-Western Companies first used the rail motor-cars on their Southsea branch, but since then the Great Western, the Great Northern, the Midland, the North-Eastern, and many other companies had adopted the same method of working on their small lines. Then there were the road motor-omnibuses, which were provided to act as "feeders" to the railways. He must say that so far as they themselves were concerned, their experience of these omnibuses had not been very satisfactory. They had not succeeded in getting the proper omnibus, but they were gaining experience daily, and they hoped by these omnibuses to be able yet to deal satisfactorily with certain districts which were now cut off from railway accommodation, and thus bring the people to their line. Another new development was in connection with automatic signalling, which had so far worked very satisfactorily on

their line, and the system would be extended as opportunity offered. Last, but not least, he might mention that the company had also recently adopted a mechanical fog-signalling apparatus, which did them great service during the disastrous fogs at the end of the year, and which, he was assured, relieved a large number of their servants from great risks.

Mr. C. T. Yerkes and the District Railway.

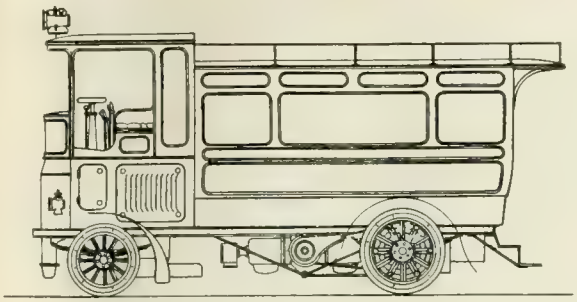
The election of Mr. Charles Tyson Yerkes to the chairmanship of the Metropolitan District Railway places him in a vastly important position in relation to electric traction in the Metropolis, which owes more to Mr. Yerkes and to Sir George White, the one an American and the other a Bristol financier, than to any enterprise on the part of London itself. Sir George White has retired from active participation in the progress of electric traction in London, but Mr. Yerkes, who succeeded Sir George as chairman of the London United Tramways, is also at the head of that important enterprise the Underground Electric Railway, which in addition to owning a controlling interest in the District Railway and the London United Tramways, is dominant partner in the Baker Street and Waterloo Railway, the Great Northern, Piccadilly and Brompton, the Charing Cross, Euston and Hampstead, and the Hampstead and Edgware lines.

MR. CHARLES TYSON YERKES.

Tramways and Light Railways Association.

At the ordinary general meeting of the Tramways and Light Railways Association, held on Friday last, Mr. Arthur Stanley, M.P., was elected president for the ensuing year. Mr. Alfred Baker, the president, was in the chair. The main objects of the Association are to promote, encourage, and facilitate the construction, extension, and working of tramways and light railways, to develop electric and other modes of mechanical traction, and to give to the Legislature and to public bodies and others facilities for conferring with and ascertaining the views of persons engaged or interested in the construction, working, and development of tramways and light railways. The following gentlemen were elected to fill vacancies on the council: Mr. H. England, Mr. J. B. Hamilton, Mr. J. H. Rider, Mr. S. Sellon, and Lord Vaux of Harrowden. The President in the course of his observations said he believed that if anybody invented a cheaper mode of traction than that of a metal wheel on a metal rail it would run them off the road, but it would not be done by motor omnibuses.

The entry of the picture post-card into business affairs has been chronicled on several occasions in PAGE'S WEEKLY. The latest instance is such a charming little card, entitled "His Private Secretary," which we have received from the Yost Typewriter Company, Ltd. The picture is not spoilt by advertising matter, and the Yost Typewriter Company, Holborn Viaduct, E.C., offer to send one on receipt of a stamped addressed envelope, to any reader mentioning this journal.



LONDON AND SOUTH-WESTERN RAILWAY OMNIBUS, BY CLARKSON, LTD.

THE OLYMPIA MOTOR SHOW.

(*Continued from page 287.*)

THE BROTHERHOOD CAR.

Something approaching a sensation has been created among automobile engineers by the new All British Brotherhood car, for the engines of which the firm of Peter Brotherhood are responsible. Innovations are introduced in almost every detail, and some of these are shown in our illustrations. The self-regulating carburetter (fig. 1), is one of the most striking features, and while it is capable of adjusting the explosive mixture to a very fine degree, it is not in itself constructed delicately or with any excessive complication as is generally the case with automatic carburetters. The petrol supply passes through a long tapered jet with a very ample bore, but is controlled to a fine degree with a long needle, and consequently is not subject to the occasional blockages which occur in the case of the usually fine petrol jet that the slightest foreign matter will choke. Moreover, the parts controlling the various functions of the carburetter being all connected to one spindle cannot get out of adjustment with each other. It is claimed that it automatically assures the even and quiet running of the motor at low speeds.

The ignition is high tension on special single Cartridge coil and trembler only from four cylinders. The commutator (fig. 2), and high tension distributor are mounted on one car on dashboard.

The gear changing is arranged so that missing gear is rendered impossible, and the case of control, through the clutch pedal and the throttle, will appeal to the practical man. The radiator has the tubes staggered and so arranged as to assure cool air, coming in contact with all surfaces of tubes and fires. There is a new design of compensated bank brake made of two semi-circular stiff steel bands, carried on two pivots, accurately machined, so as to exert uniform pressure on all points of contact with circumference of brake

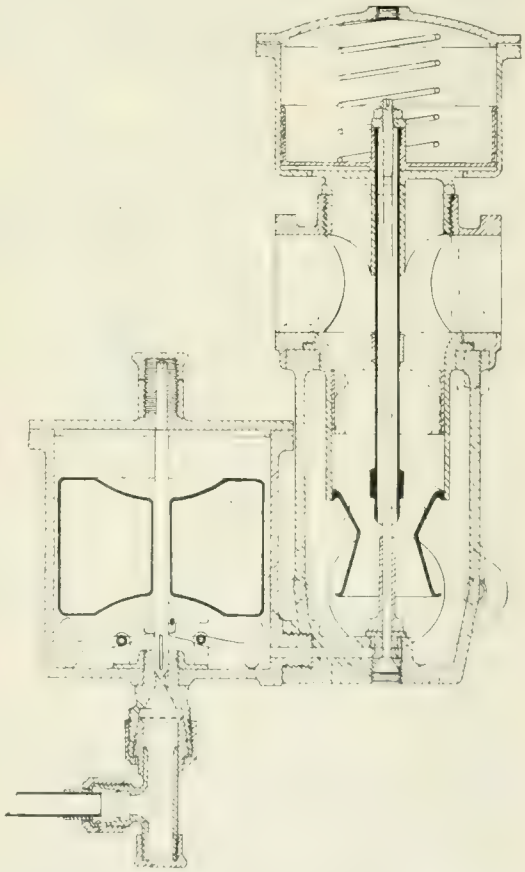


FIG. 1. SECTIONAL ELEVATION OF CARBURETTER. BROTHERHOOD-CROCKER MOTORS, LTD.

pulley. There is extended spring scissor motion at fixed pivot, assuring immediate release when thrown off, and preventing contact when not in use, and direct pull on by toggle motion.

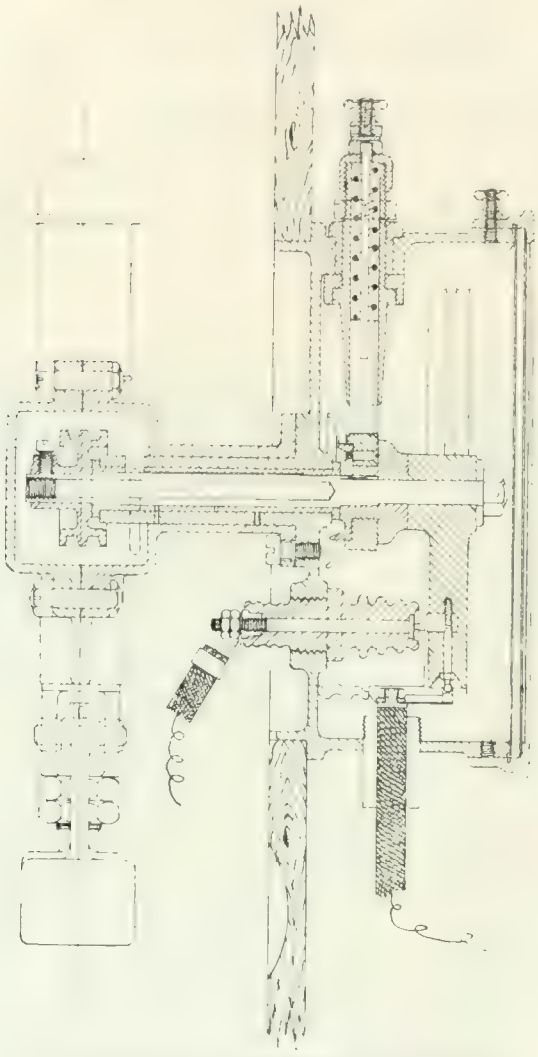


FIG. 3. LONGITUDINAL SECTION—BROTHERHOOD-CROCKER COMMUTATOR.

"CHELMSFORD" OMNIBUSES.

The stand of Clarkson, Ltd., of Chelmsford, shows various types of motor omnibuses. The exhibits comprise the latest types of the "Chelmsford" steam omnibus, the new double-deck omnibuses to carry thirty-four passengers, built for the London Road Car Company, and specimens of both large and small single-deck omnibuses, intended for railway and country service. One of the new 32 h.p. steam omnibuses built for the London and South-Western Railway is shown on page 343.

One of the principal features of the motors made by this firm is that they are designed for the employment of heavy oil, or paraffin fuel, instead of petrol. This reduces the fire risk very considerably, and no special precautions as to the use of naked lights in the garage are necessary, since inflammable vapour is not given off at the ordinary temperature, as in the case of petrol. Also, in the event of serious collision, causing a rupture of the fuel tank, there is practically no risk of fire. The importance of this feature for public service cars is obvious. Fig. 4 shows a standard "Chelmsford" engine, which is fitted with the Clarkson patent system of lubrication. Broadly speaking, there are two methods of lubricating a bearing; in the first, the rate of feeding is adjusted as far as practicable to the actual requirements; in the second the bearing is liberally flooded and the surplus recovered. The second method implies that all the bearings are effectively enclosed. The description given refers to the Clarkson lubricator, which is designed on this second method. The oil is delivered by the pump into the pipe and fills the box, the only outlets are a ring of holes, each of which communicates with a bearing. This ring of holes is covered by a circular disc, which is slowly revolved by the motor. On one side of the disc a segment is cut out, so as to uncover one hole at a time, and the desired result is accomplished. Care is taken to make the segment wide enough to partially open the next hole before closing the last. Any number of branches may be used.

The arrangement is said to work perfectly. After running over 3,000 miles, a Chelmsford engine fitted with it was taken to pieces and examined. The surfaces were found in perfect condition, and there was practically no wear. The same system is applicable to cylinder lubrication.

"CLIFT" MARINE MOTORS.

This motor, which is illustrated in fig. 9, is made by the Kensington Motor Company, and is shown on their stand in the Annexe at Olympia, where the marine section of the exhibit is housed. The motor is of the four-cycle type, and fig. 9 shows one of its distinguishing features. On the inlet side of each cylinder is a release compression port which is seen uncovered on the forward cylinder. A vertical arm pivoted on a lug, at the side of the carburetter drops over the port and is fastened at its lower extremity by a winged nut fastened to a swinging

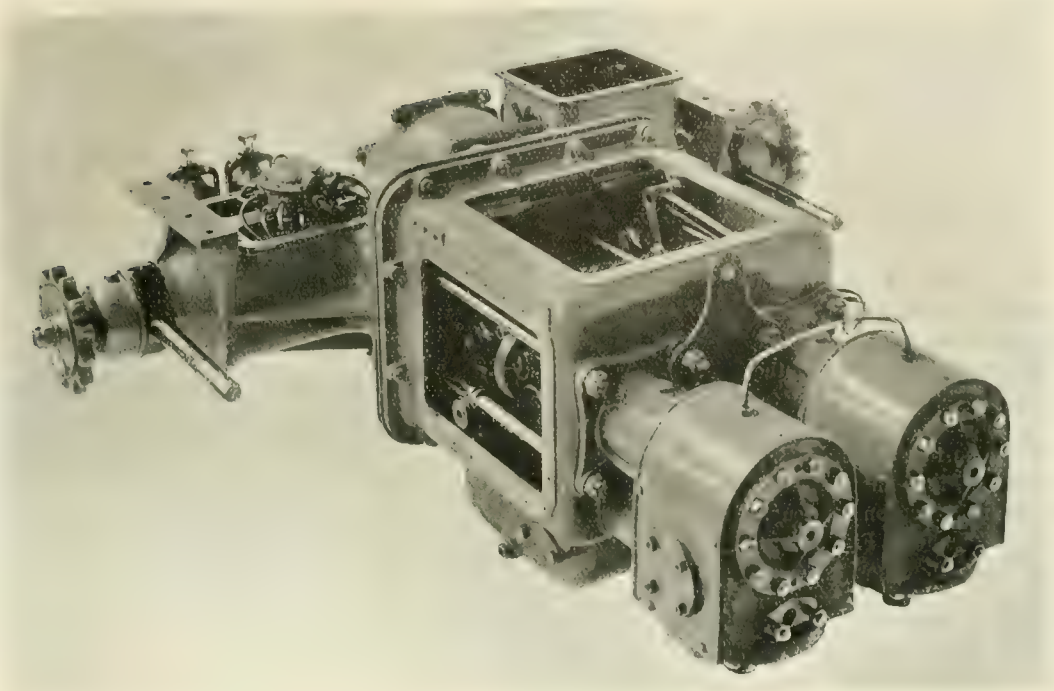


FIG. 4. STANDARD "CHELMSFORD" ENGINE, WITH COVER OFF, BY CLARKSON, LTD.

bolt, which, when lifted up, fits into a slot in the arm. This arm carries on the inside a spherical head, which closes the release compression port, a washer being used to make a gas-tight joint. Provision is made to hook the arm up to the carburetter when the compression on any cylinder is released. The advantage of this device are obvious enough, the primary intention, being, of course, to facilitate the removal of a valve from any cylinder while the engine is running, while the arrangement of the parts permits the replacement of a sparking plug without stopping the motor. Accessibility to the crank case has also been an object in design. The motor runs up to 1,000 revolutions per minute, developing 30 h.p., with cylinders of 4½ in. bore by 5 in. stroke, but the best speed at which to run the motor is 700 revolutions per minute.

CROSSLEY PETROL ENGINE.

This engine which is shown by Messrs. Charles Jarrott and Letts, Ltd., is made by Messrs. Crossley Bros., of Openshaw. The illustrations show transverse and longitudinal sections, with an end elevation and plan. One of the most striking features of the engine is the valve which varies the volume of the charge drawn into the working cylinders. A reference to fig. 5 will show that the inlet-valves, A, and the exhaust valves, A1, have their seats arranged on a somewhat lower level than the port leading from them into the working cylinder, and that the gases therefore tend to pass more equally around them, instead of on the cylinder side only, this being particularly important for the exhaust-valves, because it reduces the tendency for the valve to be heated to a greater extent on the one side than the other.

The cylinders and their pistons are made of hard cast iron, and their exact shape is shows in figs. 5 and 6, where also the hollow gudgeon pins and the connecting rods are shown sectionally and in elevation.

The crank chamber is so shaped that it encloses the lower portions of the gear wheels drawing the cam shafts and a separate casing, D3, completes this casing

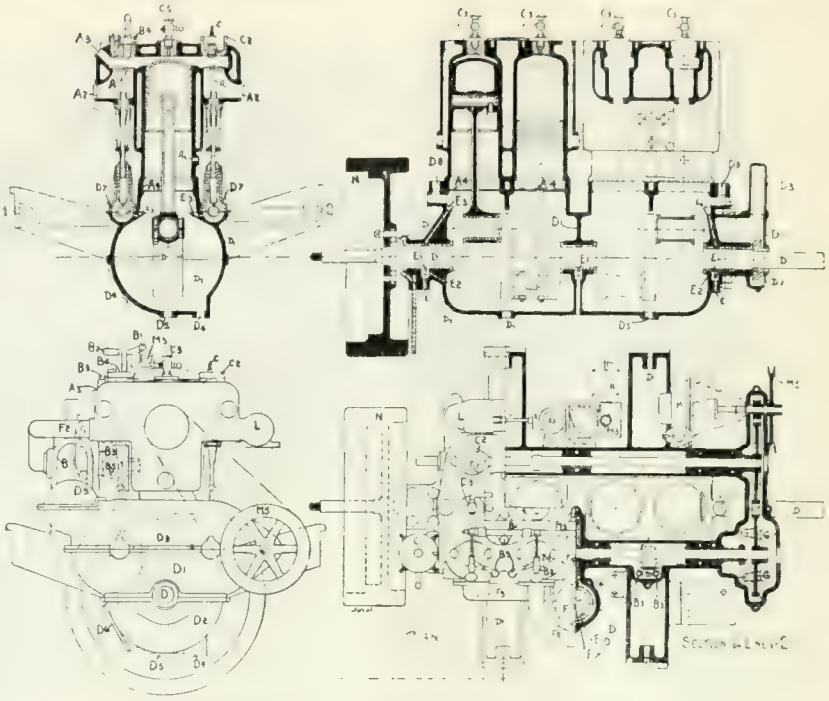
The crank shaft, D. made of nickel steel, is machined all over from a forging. Messrs. Crossley have adopted the special system, developed by them for their ordinary gas-engine crank shafts, which will be familiar to readers of PAGE'S WEEKLY, for this four-throw crank shaft. The flywheel, N, is fixed to the crank shaft by bolts passing through a registering flange, which forms a part of the solid forging. The igniters, B4, are operated by the disc-cams, two of which are seen on the inlet cam shaft in fig. 8, these cams engaging with projecting arms mounted on the

lower ends of the vertical rock-shafts, B3. The time of ignition is varied by raising or lowering the rock-shafts, B3.

The governor, G, is shown in Fig. 8; it is fitted inside the large spur-wheel which drives the inlet cam shaft. It is of the ordinary centrifugal type.

The engine is capable of working at any speed between 80 and 1,200 revolutions, this wide range being due to the specially-designed carburetter.

Fig. 5 herewith shows vertical cross section through one of the cylinders. Fig. 6 shows vertical longitudinal section through centre of engine. Fig. 7 is a front elevation. Fig. 8 is a part plan and part horizontal section through cam-shaft.



CROSSLEY PETROL ENGINE, FIG. 5, 6, 7 AND 8.

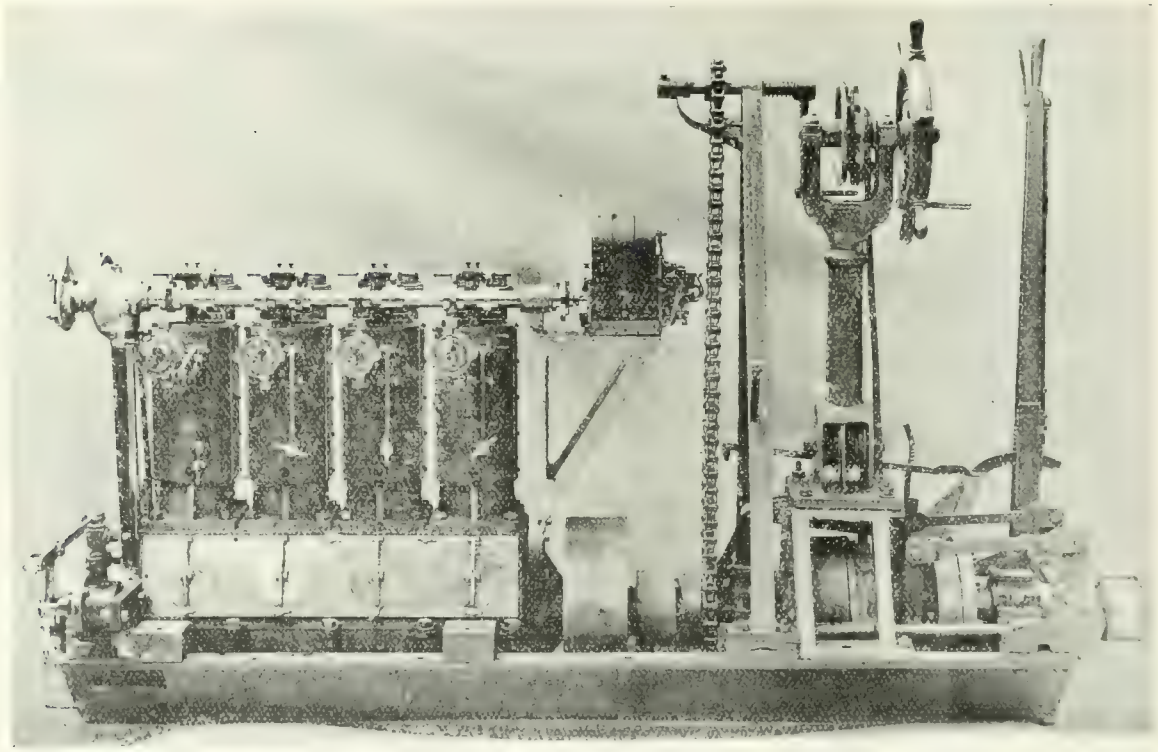


FIG. 9.—"CLIFT" MARINE MOTOR, PORT-SIDE. 30 B.H.P. 4 CYLINDERS, 4½ IN. × 5 IN.

HADFIELD'S PATENT "ERA" MANGANESE STEEL IN CRUSHING MACHINERY.

THE Hadfield and Jack's Patent Gyratory Crusher, illustrated in figs. 1 and 2, is one of ten which have been constructed for the Premier Diamond Mines to deal with approximately 800 loads of blue ground per hour. It is the latest product of the two large machine shops which have been recently added to the East Hecla Works of Messrs. Hadfield's Steel Foundry Company, Ltd., Sheffield, for the construction of Stone and Ore Crushing Machinery. The machine is of particular interest because it represents one important practical outcome of the research work which has earned the Hadfield Company such a wide reputation in the metallurgical world. The importance of lightening this class of machinery needs no emphasis. In the present instance it has been secured by the institution of cast steel parts for constructions in which cast iron was formerly employed, while the portions of the Crusher most subject to wear and tear have been as it were, "armoured" with "Era" manganese steel, thereby ensuring for them a considerably enhanced durability.

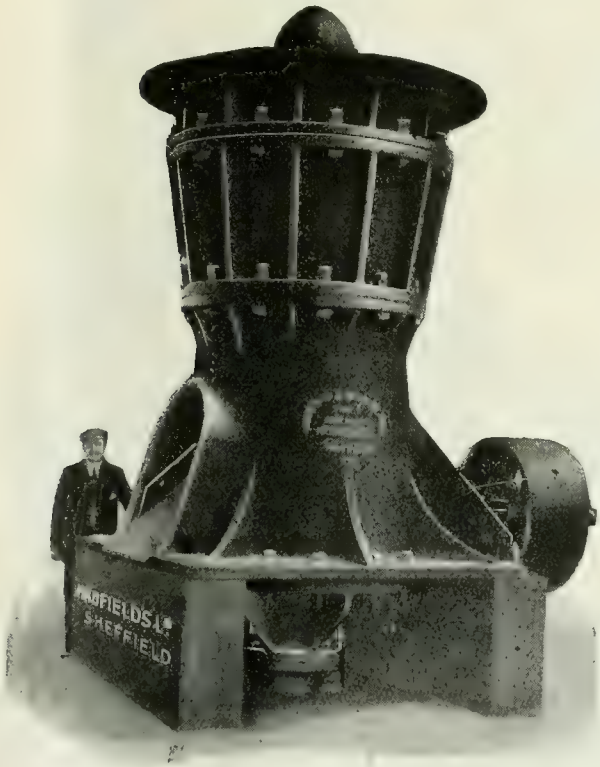


FIG. 1. HADFIELD AND JACK'S PATENT HECLON GYRATORY CRUSHER.

The Heclon Crusher has also a number of mechanical improvements which make for reduced frictional resistance, and provide for the protection of the interior mechanism from dust. Its construction will be readily understood from fig. 2. The lower part of the body portion of the breaker is of cast iron, the upper part being of cast steel lined with concave plates of "Era" manganese steel. The hopper, of cast steel, carries a 3-arm spider supporting the boss.

The shaft T is hollow, fitting over and protecting the eccentric, which is also guarded from dust by the dust-collars V and S1. Its weight is carried on a brass ball bearing at the upper end where the motion is practically nil. The crushing-cone, of "Era" manganese steel, is not revolved by the shaft, but has an oscillatory motion transmitted through the shaft by an eccentric boss cast in the base gear wheel G, the thrust from the eccentric being taken by a steel sleeve C, which is securely attached to the cast iron

bed-plate. The worm-wheel, shown at the lower end of the shaft 1, serves to wind it up or down, thus regulating the degree of fineness to which the blue ground is to be reduced. The actual crushing parts of the machine are lined with "Era" manganese steel, which can be renewed.

The bushes between the sleeve C and the inner surface of the eccentric boss and also between the outer surface of the latter and the inner surface of the shaft, are of anti-friction metal, and can easily be withdrawn for examination.

The lubricating system is carried from a base situated above the level of the main bearing, the oil passing through a hole bored in centre of shaft. A constant drip of oil is maintained, and after passing over the inner and outer bushes, finds its way under the dust ring S1, and partly past the inner bearing down to the base plate whence it is recovered through a small pipe in the bottom-plate.

The machine is driven by a pulley through the medium of safety breaking pins and a bevel pinion on the wheel G, the shaft bearing being exceptionally long and lined with anti-friction metal.

The other machines, figs. 3—6, illustrate further applications of the "Era" manganese steel to crushing machinery. In fig. 3 is shown a special type of revolving screen designed by Hadfield's Steel Foundry Company, Ltd., best toughened cast steel in this case being used for all the parts subject to heavy working strains. When so required, these screens are fitted with perforated plates of "Era" manganese steel.

The use of this special metal for the jaw-faces, side-cheeks, toggle-plates and grooves in the reciprocating stone-breaker is illustrated in figs. 4 and 5, and here, again, cast steel parts have

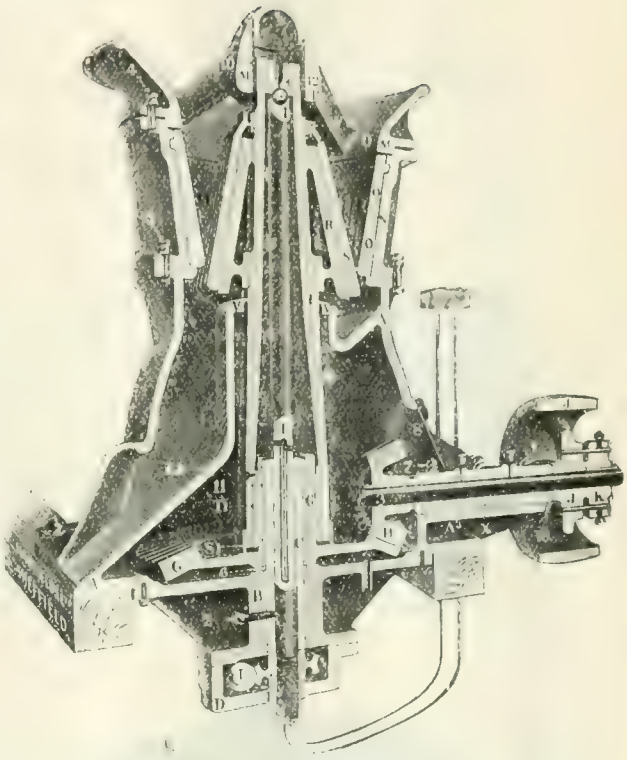


FIG. 2. SECTION OF THE HECLON CRUSHER.

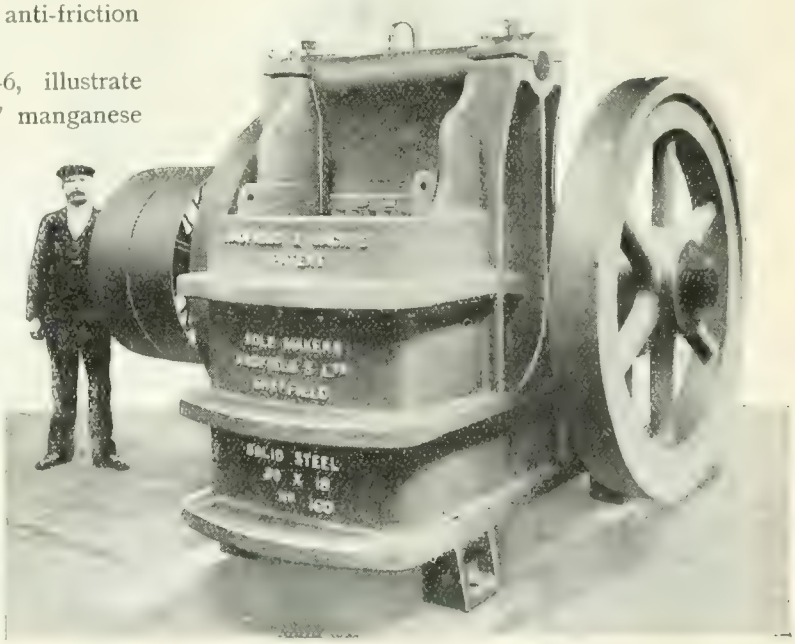


FIG. 4. HADFIELD'S PATENT SOLID STEEL JAW CRUSHER

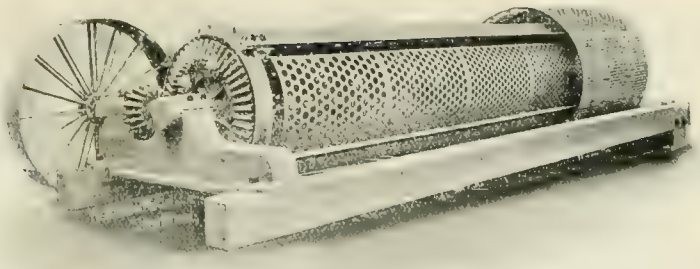


FIG. 3. REVOLVING SCREEN.

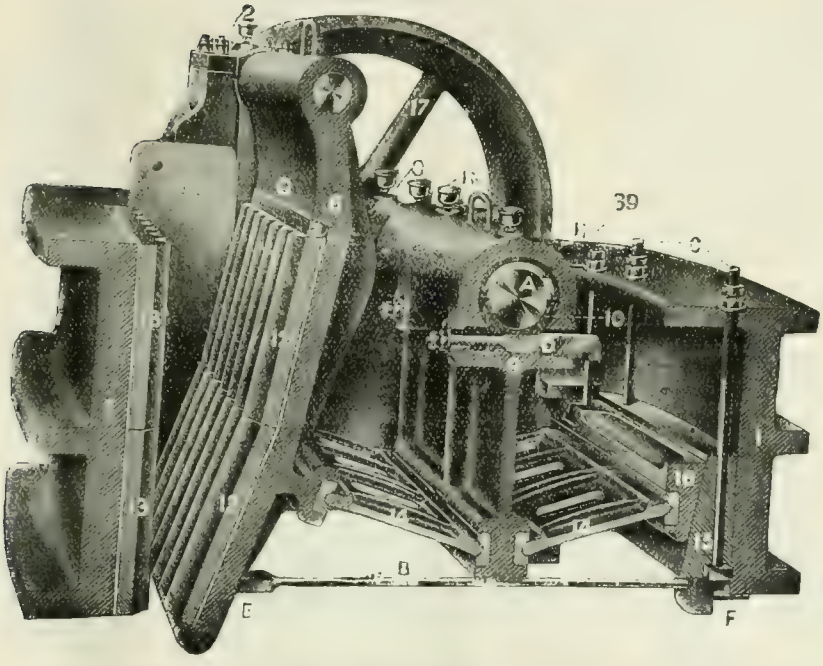


FIG. 5. SECTION OF HADFIELD'S PATENT SOLID STEEL JAW CRUSHER.

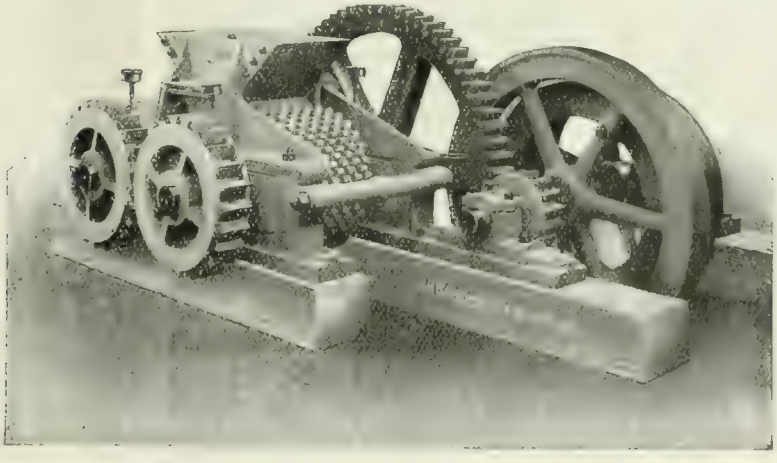


FIG. 6. TOOTHED CRUSHING ROLLS (GEAR DRIVEN).

been introduced with marked effect upon the weight. The back of the jaw-face has V grooves filled with hard spelter, which permits it to be slipped into place with the same readiness as a cast iron jaw-face with a planed back, and ensures equally as good a fit.

Similar metals are used in the construction of the crushing rolls (fig. 6), intended for dealing finally with partly-crushed material. In this case the use of "Era" manganese steel enables the teeth of the rolls to be made of thinner and longer section, thereby procuring better results and also a longer life for the teeth than was formerly possible by the use of chilled iron.

It may also be mentioned that "Era" manganese steel plays an important part in the production of links, pins, sprocket wheels, and other parts of elevators and conveyors which are specially subject to heavy wear and tear. In fact, this special steel is particularly applicable wherever there is severe abrasive action and, we are assured that in many cases Messrs. Hadfield, Ltd., are able to show records of wear in the ratio of 5 to 1, 6 to 1, and even more as compared with iron.

NOTABLE TECHNICAL INSTITUTIONS.

ARMSTRONG COLLEGE
IN THE UNIVERSITY OF DURHAM), NEWCASTLE-UPON-TYNE.

By Stanley Parker Smith, B.Sc.

SITUATED in the very heart of one of the most important engineering centres of the United Kingdom, the Armstrong College ranks among the foremost institutions in the world for the training of engineers. The name of the College, formerly known as the Durham College of Science, has been recently changed to the Armstrong College, in memory of the late Lord Armstrong, a name which will probably be regarded by engineers as signifying that engineering is looked upon as amongst the most important of the various subjects taught at the College, which is one of the chief University Colleges in the country. Like many other institutions of its kind, it has had a hard struggle to establish its claim as a training ground for modern and scientific engineering; nor can the victory yet be said to be quite won, as it is only by the recognition of those who have done well, after successfully going through the College course, that the prejudice against university men can be overcome. There are still many engineers on Tyneside, as well as elsewhere, who hold that young apprentices can gain their experience as their fathers and forefathers did, and that a college man is lazy or incompetent. They seem to forget that, when they began their career, engineering in all its branches was conducted on vastly different lines. Of late years science has been so applied to the arts that, unless a man has received a thoroughly scientific education, he cannot hope to reach the highest ranks of his profession.

The chief firms in the district are now beginning to recognise the claims of the College, and to look upon it as a desirable and necessary institution; in fact, in many cases, these firms work hand-in-hand with the College. The college course is not intended to be a substitute for the term of apprenticeship, but it is so arranged that the student apprentice may benefit to the fullest possible extent by the combination of his scientific and practical training.

METHODS OF TRAINING.

Many of the students enter on the "sandwich" system, by which they combine the experience gained in various drawing offices, works, shipyards, etc., with the knowledge gained at college. Such a course often extends over five or six years—two or three sessions at college and two or three years in the shop. Other students prefer to serve their apprenticeship first and then come to college, whilst others again reverse this order. With regard to the work accomplished, it may be first of all pointed out that when any man enters the College, he very soon learns that if he wishes to attain success he must work, and work hard. Whether it is right or not to crowd four years' work into three, is another matter; but it is a well-known fact in the College that unless a man chooses to work hard he will not earn his degree or diploma, as the case may be. On the other hand, this is one of the chief causes that makes the engineering degrees and diplomas of this university so highly valued.

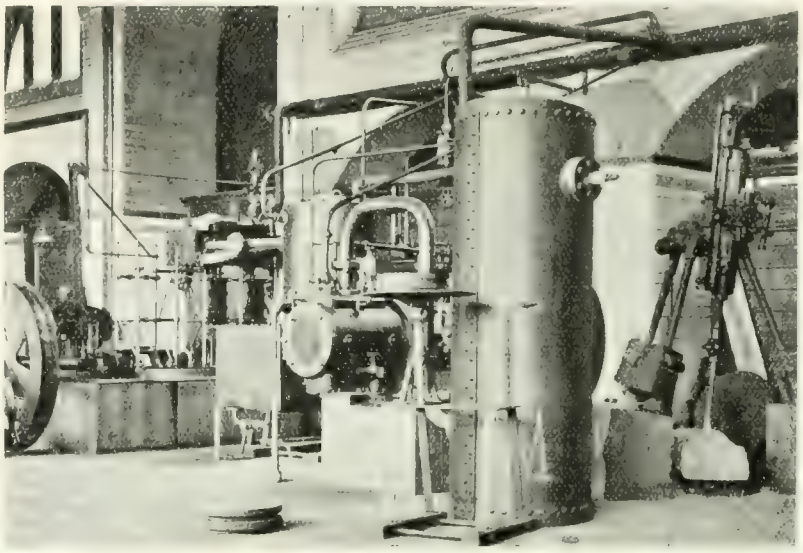
ENGINEERING STAFF.

In describing some of the chief features of the College of interest to engineers generally, we may in the first place devote a few words to the engineering staff. Each branch of engineering has its own lecturers; the head of the engineering department being Professor Weighton, M.A.; of the mining department, Professor Louis, M.A.; and of the electrical department, Dr. Thornton, M.I.E.E. Of Professor Louis we need add little to what was said in a biography of him which appeared in a recent number of Page's Weekly. He holds that before anything else, a student must be a man of character, and although he may rise to positions of eminence and responsibility, he must always continue to progress, for as soon as a man ceases to acquire knowledge his usefulness begins to decrease. Professor Weighton is one of the most respected men in the College. He is admittedly master of his subject—his wide experience being gained from years of practice and study. His personality is such that he commands esteem from all his students, in whom he takes great interest.

Dr. Thornton is probably best known to the outside world by his valuable experimental researches which have been dealt with from time to time in the technical press; but among the College students, there is a deep feeling of respect for him in consequence o

FIG. 1. GENERAL ARRANGEMENT OF THE ENGINEERING LABORATORY, ARMSTRONG COLLEGE.

FIG. 2. A CORNER OF THE ENGINE ROOM



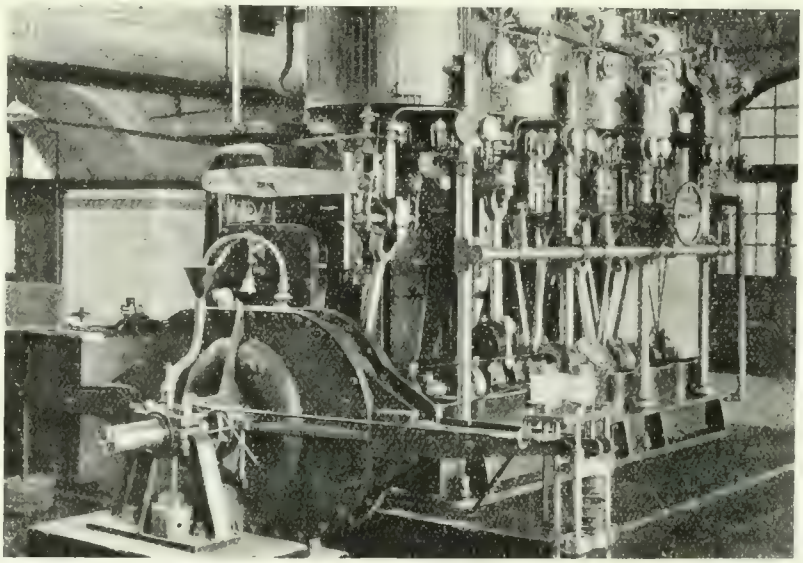


FIG. 3. MINING MACHINERY AT THE ARMSTRONG COLLEGE.

FIG. 4. EXPERIMENTAL ENGINES.

his kind personal interest in their work. He is ever engaged in research, and delights to have the senior students under his guidance, doing any similar work that may appeal to them. Moreover, his own genial nature and dogged perseverance help them over endless difficulties which would otherwise prove most disheartening.

Every opportunity is taken of cementing the friendly relationship existing between the teaching staff and their students by means of social intercourse. At a recent engineers' dinner (which promises to become an annual function) Professor Weighton remarked on the goodwill existing between the different engineering sections of the College, and strongly emphasised the important position which the engineers hold there. He was glad to know that on the completion of the new buildings they would have a wing of the building practically to themselves. Professor Louis on this occasion mentioned that the College had supplied more Inspectors in Mining than any other in the kingdom, whilst its representatives in one form or another were to be found in almost every part of the world. An engineers' committee was formed as a result of this dinner to organise the engineering interests of the College. It is composed of members of the staff and representatives of the students, and has to look after the welfare of considerably more than one hundred students.

THE COLLEGE COURSES IN ENGINEERING.

We will next describe briefly the courses of study undertaken at the College. They may be divided into three classes: (i.) Degree of B.Sc.; (ii.) College Diploma; (iii.) Special Courses.

(i.) The course for the B.Sc. in Engineering may be taken in any of the following branches: (*a*) General Mechanical Engineering; (*b*) Naval Architecture; (*c*) Civil Engineering; (*d*) Electrical Engineering (including Mechanical Engineering); (*e*) Mining; (*f*) Metallurgy. These courses extend over three years. FIRST YEAR.—This is a preliminary course in general science, and is the same for all men taking their degree in any branch of technology. There are four subjects—mathematics, physics (theoretical and practical, chemistry (theoretical and practical), and mechanical drawing. SECOND AND THIRD YEARS.—In the second year the engineers begin to specialise, the various courses being chosen from the following subjects in the second and third years: applied mechanics, engineering and engineering laboratory, mechanical drawing, naval architecture, surveying, practical geology, electrical engineering and laboratory, economic mineralogy, mineral deposits, mining, dressing of minerals, general metallurgy and assaying, etc. In addition to the above, most of the degree students are required to take auxiliary subjects, such as physics chemistry, or mathematics.

(ii.) The diploma courses extend over two years for a second-class certificate and three years for a first-class. The diploma may be taken in: (*a*) engineering (including electrical engineering); (*b*) naval architecture; (*c*) mining. The subjects taken are the same as above, but are modified to suit each special case.

(iii.) The special courses are arranged to meet individual requirements.

THE COLLEGE BUILDING AND THE HOUSING OF DEPARTMENTS.

Each branch of engineering has, or will shortly have, on the completion of the new buildings at the College front, its own class-rooms, and laboratories. The Engineering Drawing Office, which measures 123 ft. by 34 ft., is one of the finest rooms in the building. The Engineering Laboratory — which is beneath the Drawing Office and is of similar dimensions, is fitted with all kinds of experimental machinery, etc. The general arrangement is shown in fig. 1. In this laboratory the junior students are made to perform a series of experiments to illustrate the first principles given in the classes.

The chief pieces of machinery in this laboratory are a set of vertical quadruple-expansion experimental engines (fig. 4). These engines are capable of working up to 200 i.h.p., at 160 revolutions per minute, with a boiler pressure of 210 lb. per square inch. They are surface condensing, and are so constructed as to be capable of being worked quadruple, triple, double or single expansion, under any required conditions of steam pressure or total expansions of the steam. The cylinder ratios, the cut-off in each cylinder, and the crank angles can be altered at will. The dynamometer is of the Froude hydraulic type, and is fitted with automatic recording gear for both the b.h.p. and revolutions in a given time. The several parts of the engines and boiler (which is of the multitubular marine return-tube type) were constructed, and presented to the College, by forty-six different firms from designs by Professor Weighton.

The vertical testing machine is of the Buckton type, and is capable of testing materials up to 100 tons in tension, compression, sharing and cross-breaking It is worked by a hydraulic intensifier, and is fitted with autographic apparatus for recording the relation between stress and strain. This machine was presented to the College by Mrs. Clarke in accordance

with the wishes of her husband, the late Mr. William Clarke, of Gateshead. The senior students, for one term, receive demonstrations from Mr. Cullen, the lecturer in engineering, on the uses of the testing machine, and two terms are spent in trials on the experimental engines, and lectures by Professor Weighton on results obtained by trials. There is always some research going on in connection with these engines.

There is also a direct steam-driven air compressor of the Ingersoll-Sergeant type and a rock drill by the same firm (see fig. 3). There are also shown in fig. 1 a gauge-testing machine, a Westinghouse pump, and a six-pole dynamo (given by the Pallion Company, Sunderland), connected by belt to a 15-h.p. compound steam enigne. On the extreme right of this photograph is seen the dynamometer of the experimental engines, whilst on the left is seen the intensifier of the testing machine. Fig. 2 shows a corner of the engine-room, where several pieces of electrical machinery and apparatus are placed until the new electrical laboratory is finished. When these machines, etc., have been moved to their right place, space will be afforded for a new steam plant and a motor generator set.

The principal machines at present in the engine-room include a set of Robey's horizontal compound steam engines, presented by the Worshipful Company of Drapers of the City of London. They are capable of indicating 200 h.p., with steam of 140 lb. pressure, and are coupled by a rope drive (seen in the photo) to a line of shafting, and also to a Holmes' compound dynamo capable of giving 500 amperes at 103 volts. Two useful 5-kilowatt electric machines, by Messrs. J. H. Holmes and Co. and Messrs. Scott and Mountain, are capable of being worked as generators or motors, on continuous circuits or alternating circuits of one, two, or three, phases. There is also a Duddell oscillograph shown, which is generally being used for research work. This instrument was presented by the late Mr. James Hall of Tynemouth. Other machines are a 30-kw. Parsons turbo-generator; a 20-kilowatt motor generator (given by the Newcastle-upon-Tyne Electric Supply Company); a 20-kilowatt motor (both of these work on 480 volts); a 5-kilowatt single-phase induction motor; about twelve transformers of different ranges and makes; liquid resistances; experimental switchboards; ammeters, voltmeters wattmeters, etc., of all descriptions; various lathes, drills, and other machinery and instruments of different kinds, including standardising sets used for accurate tests and experiments.

The metallurgical laboratory includes the usual furnaces for assaying and for research work. There are experimental ore dressing appliances and a small rock breaker, and also facilities for practice in panning and vanning.

In conclusion mention may be made of the advantages the engineering students derive from having such eminent men as Drs. Stroud and Bedson as professors of physics and chemistry; also Professors Jessop and Lebour in mathematics and geology, whilst the auxiliary subjects are continually being made more suitable for engineers.

One of the most prominent features in the College is the amount of original resarch done there, which is greatly aided and encouraged by the new principal—Sir Isambard Owen. The College owes very much to its position in an important centre of industry. It is surrounded by great shipyards, engineering works, collieries and ironworks, in which students are given every opportunity of gaining an insight into the practical side of the technical subjects taught at the College.

Although the above description of the purely engineering side of the College is of chief interest to the engineer, yet we might also mention that in the other departments there are, besides those mentioned, Professors in biology, botany, agriculture, classics, English literature and education; whilst there are lecturers in metallurgy, crystallography, history, modern languages, philosophy, art, etc. We might also take this opportunity of mentioning that Mr. Stanley, lecturer in metallurgy, has just been appointed to an important professorship in metallurgy in South Africa.

ICE ON THIRD RAIL.

LAST winter several electric railways in the States experienced considerable difficulty with sleet and ice forming on the third conductor rail. The climatic conditions of this country have not yet given trouble on our electric lines, but it is always a contingency which must be looked out for. Sticky wet snow or sleet are the greatest danger, and in order to remove this as it forms, a brush or cutter is employed. The latest pattern as adopted on the Brooklyn elevated railway consists of a hard maple block, into which are fixed sixteen rows of wire bristles, each row containing twelve sets. Each set of bristles consists of seven No. 23 B. and S. steel ribbons 1⅛-in. wide, and they are so arranged as to brush the rail surface broadside on. The brush is pressed downwards, with a pressure of 75 lb., and it is carefully insulated from the supporting guide bar by hardwood and fibre separators.

Deep Borehole Surveying.

AT the meeting of the Institution of Mining and Metallurgy, held yesterday, a paper on this subject by Mr. Hugh F. Marriott, was on the agenda.

The author describes the construction of two sets of instruments he has lately perfected for use in deep level borehole surveying. These instruments are the outcome of many years' experience and numerous experiments with various forms of apparatus for both mechanical and chemical action. A workable instrument must fulfil the two following requirements; with a continuously working instrument the operator must know what changes are being recorded by the instrument at the time such changes take place; and in an intermittently working instrument the operator must be able to absolutely unlock and lock the recording apparatus at will at the point at which it is required to take readings. The author finally turned to electricity as the only means of fulfilling the stringent requirements the circumstances demanded.

The illustration on page 356 refers to these two sets of instruments.

CONTINUOUSLY WORKING INSTRUMENT.

The earlier figure numbers refer to the continuously recording instrument for determining the variation in amount of dip in a deep borehole.

Fig. 1 is a vertical section of the instrument. Fig. 2 is a diagrammatic sketch of the electrical connections. Fig. 3 is a diagrammatic sketch of an alternative arrangement of the electrical connections. Fig. 4 is a vertical section of the cable head. Fig. 5 is a section of the lower portion of the cable head, showing the connections with the conductors for the current. Fig. 6 is a plan of the lower end of the cable head. Fig. 7 is a sectional elevation of a slightly modified arrangement.

The two wires or conductors *K*, *L*, which serve for passing the current of electricity through the instrument, may be connected up with a series of primary or secondary cells of ascertained electromotive force, a galvanometer, and a standard resistance box. The various resistances of the coil having been previously compared with those of the standard resistance box, the declination of the plumb-bob *F* from the vertical can always be ascertained by means of the galvanometer.

INTERMITTENTLY WORKING INSTRUMENT.

Fig. 8 respresents the instrument, removed from its casing, in part sectional elevation. Fig. 9 is an elevation of the top screw cap or plug. Fig. 10 is a plan of Fig. 9. Fig. 11 is a plan of the magnetic compass and mirror, detached. Fig. 12 is a plan of the resistance frame or coil, also detached. Fig. 13 is a sectional elevation of a modified form of the instrument, drawn to an enlarged scale. Fig. 14 is a plan of Fig. 13. Fig. 15 is a part sectional elevation of the tubular or cylindrical casing for the instrument. Fig. 16 is a transverse section of line *x*—*x* Fig. 15, and Fig. 17 is a plan of the cap or plug for closing the lower end of the casing.

After the magnetic compass *L* has been arranged in position on the needle *K*, which forms the pivot, molten paraffin wax, or other suitable material, is then poured into the tube until the lower portion of the compass attachment is well below the surface. The wax is then allowed to solidify, the top cap or plug *B* screwed into position, and the instrument then placed in the casing *P*, and the wires, *d*, *d1* connected by means of the electric cable with a source of supply of electrical energy. In use the instrument is lowered in the bore-hole to the position required to be surveyed. A sufficiently strong current of electricity is then passed through the resistance frame or spiral wire *J* for a sufficient length of time to melt or liquify the mass of paraffin wax or other material in the tube *A*.

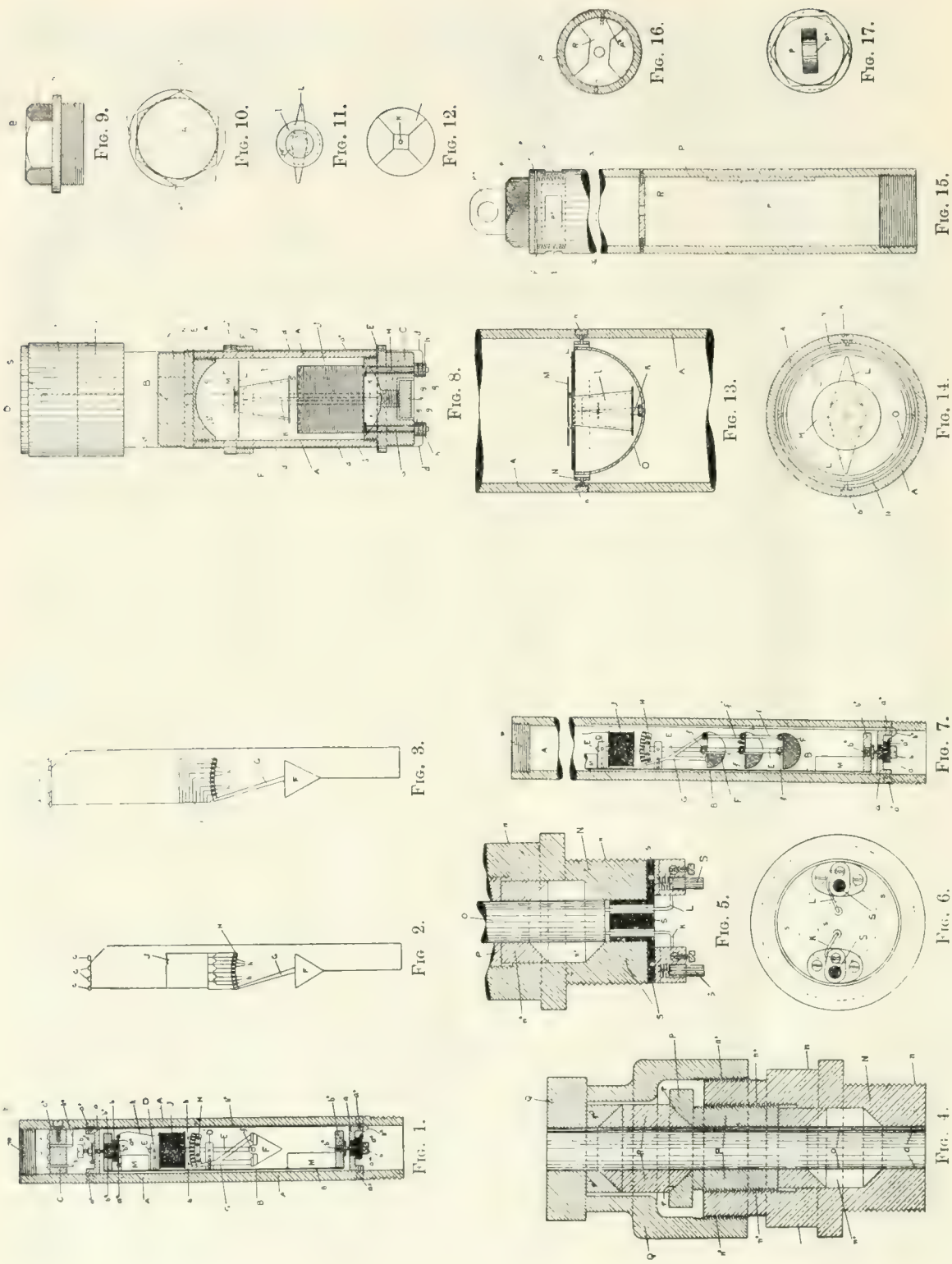


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 10.

FIG. 11.

FIG. 12.

FIG. 13.

FIG. 14.

FIG. 15.

FIG. 16.

FIG. 17.

INSTRUMENTS USED IN DEEP-BOREHOLE SURVEYING.

The current is then cut off. Thereupon the compass *L* assumes its true magnetic north and south positions. The wax is then allowed to cool and re solidify, after which the instrument is withdrawn from the borehole. The direction of dip may then be ascertained by observing the declination of the silver mirror *M* from the horizontal with regard to the direction of the compass *L*.

MODE OF WORKING.

The general arrangement of the apparatus when in working order is as follows: An iron headgear stands over the mouth of the borehole to be surveyed, and the geared drum carrying the electric cable stands at a convenient distance to the rear of this. In the headgear is a measuring wheel of extreme accuracy, a vital point where there are known obstructions at various points in the hole. The cable is ½ in. in diameter, and contains two highly insulated conductors. It is designed to support its own weight and that of the instrument in a waterless hole of 5,000 ft. depth if necessary.

One end of the cable is attached to the head above described, and the other is connected in the interior of the drum to two concentric contact rings, which are placed in communication, by means of carbon brushes, with the galvanometer in the continuouly recording instrument, or the source of electrical energy in the intermittently recording instrument. The galvonometer itself is of special design, and is calibrated to read, at a pressure of about 4 volts, the make-and-break records of the continuous clinometer, and it is also designed to record the rise in temperature indicated by an electrical thermometer.

The author gives diagrams of results obtained from surveys of two boreholes sunk on the property of the Turf Mines, Ltd., which were made with these instruments, and which bring out the service which they are likely to render to the mining industry.

INSTITUTION OF CIVIL ENGINEERS.

At the last ordinary meeting, Sir Guilford Molesworth, president, in the chair, it was announced that 19 associate members had been transferred to the class of members—viz., Messrs. W. Bates, E. T. Beard, O. F. L. W. Cuffe, C. R. Fenwick, C. O. Grimshaw, D. J. Highet, J. N. Kirby, C. N. Lailey, O. C. Lees, C. F. Marsh, E. H. S. Napier, H. W. Parkinson, J. S. Pickering, A. Powell, T. Pridham, G. Rankin, P. J. Sheldon, A. T. Snell, and E. R. Waight. The monthly ballot resulted in the election of seven members—viz., Messrs. F. Hellmann, J. B. Hunt, J. Inglis, D. Macdonald, C. B. Smith, Ma.E. (McGill), J. F. Sorzano, and G. W. Wolff, M.P., 20 associate members—viz., W. H. C. Clay, J. L. Cridlan, H. Dalgarno-Robinson, J. D. D. Davis, T. S. Ennis, B.E. (Royal), Don E. Ferro, B.A. (Colombia), E. P. Harvey, B.A. (Cantab.), A. G. F. Heather, L. H. L. Huddart, B.A. (Cantab.), W. C. Isle, B.Sc. (Victoria), J. M. Mackay, M. S. McKay, B.A., B.A.I. (Dubl.), (London), R. C. S. Murray, B.A. (Cantab.), I. V. Robinson, G. W. Shearer, B.Sc. (Glas.), A. O. Sherren, E. D. Simon, B.A. (Cantab.), P. B. le D. Tree, R. P. Wilson, and W. R. Wilson, B.Sc. (Glas.)

OBITUARY.

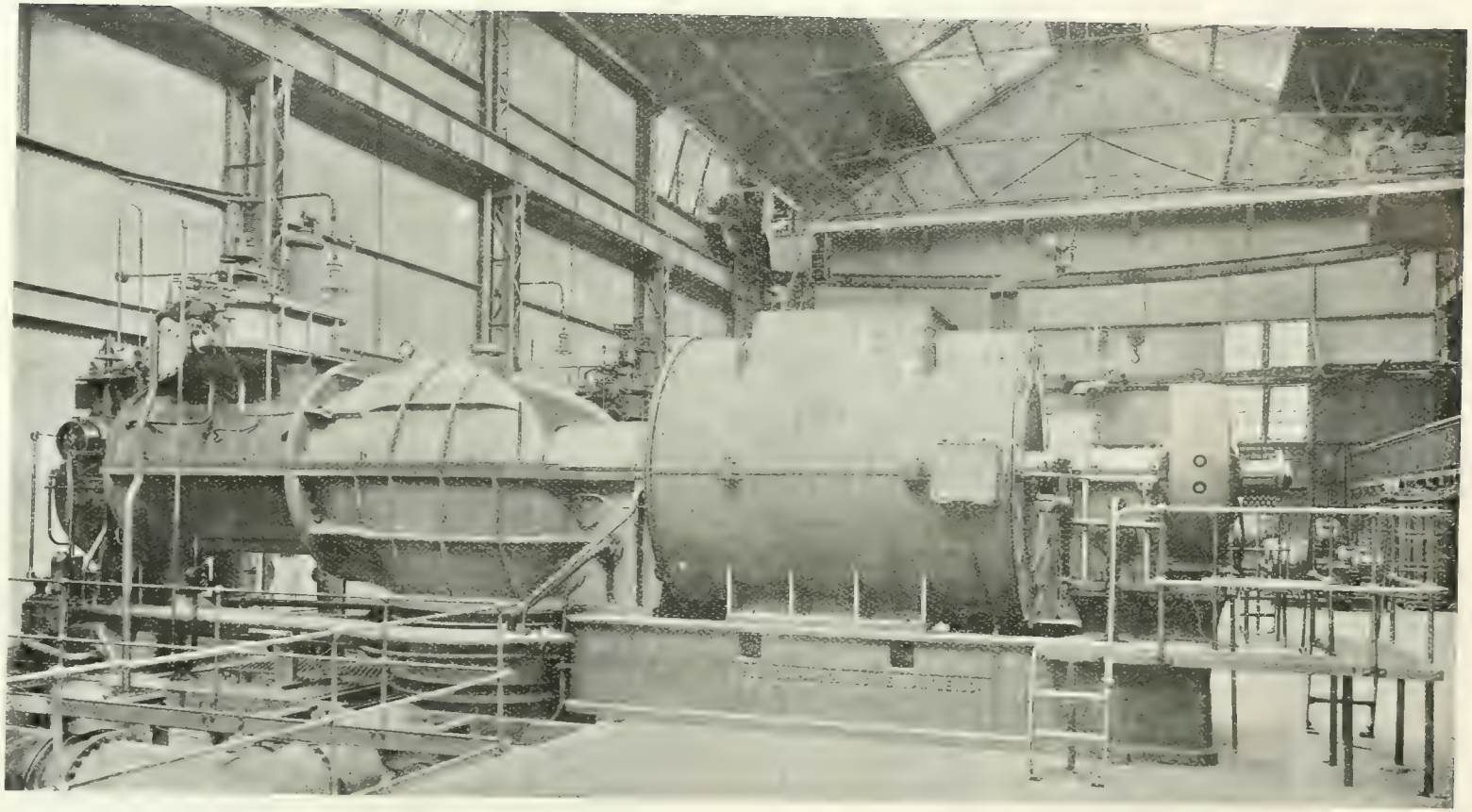
The name of Mr. William Sellers, whose death is reported in our American contemporaries, was a well-known one in transatlantic engineering circles As long since as 1864 he was president of the Franklin Institute, and while acting in that capacity he read a paper on "Screw Threads and Nuts," which has since become the standard for the United States and the form of thread for the continent of Europe.

Mr. Sellers was a trustee of the University of Pennsylvania, a member of the National Academy of Sciences and corresponding member of the Paris Societe d'Encouragement pour l'Industrie Nationale He was also a member of the Institution of Mechanical Engineers, the Institution of Civil Engineers, the Societe d'Encouragement pour L'Industrie Nationale of France, the American Society of Civil Engineers and the American Society of Mechanical Engineers.

Since he assumed the secretaryship of the Chartered Company, Mr. John Frank Jones had become a public official, and in that capacity had displayed abilities of no mean order. Latterly, in addition to his secretarial duties, he become joint manager of the British South African Company, and by his death Rhodesian interests have lost a man who had rendered yeoman service.

Mr. Charles Lockhart, president of the Lockhart Iron and Steel Company, Pittsburg, with plant at McKees Rocks, Pa., and one of the largest stockholders of the American Ax and Tool Company, of New York, whose plant is located at Glassport, Pa., died at his home in Pittsburg on January 26th.

The death of Mr. George Beattie, removes a familiar figure from commercial circles on Tyneside. He commenced his business career with Messrs. James Joicey and Co., and was for many years in later life in business at Tyne Dock. Mr. Beattie was Mayor of South Shields in 1901.



RECENT TURBINE INSTALLATIONS—(1) 5,000 KW. TURBO-ALTERNATOR AT CARVILLE POWER STATION.

Our illustration shows one of the Parsons steam turbo-alternators supplied by Messrs. C. A. Parsons and Co. for the Carville Power Station, of the Newcastle-upon-Tyne Electric Supply Company.

In the 5,000-kilowatt sets all the blades are laced in the high as well as the low-pressure chambers and on both the stator and the rotor. In the case of the low-pressure blades, lacing is effected in the ordinary manner by means of wire at the ends and also half-way down the blade. The lacing of the other blades consists of a ring of metal of the same material as the blades brazed on to the blades. A cross-section of the ring measures ¼in. square, and it is brazed for each blade in succession, recesses being cut for this purpose. The alternators are of the revolving field type, directly connected to the rotor shaft of the turbine. At normal speeds they generate three-phase current at 6,000 volts.

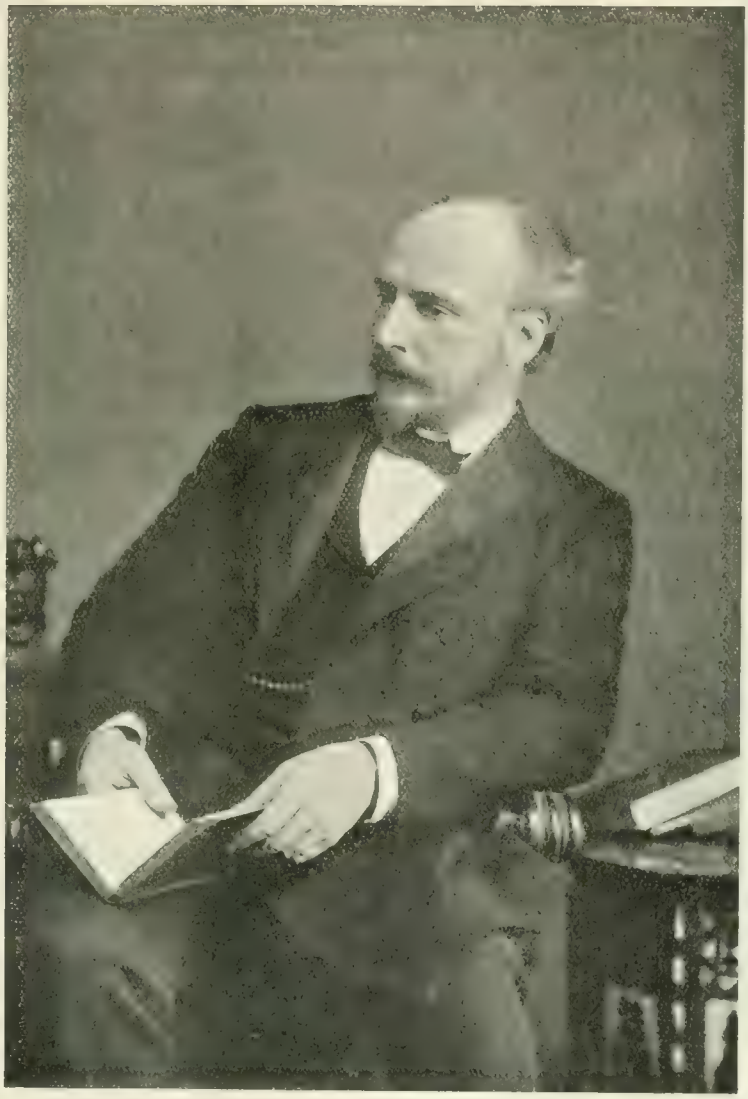


Photo by Elliott and Fry.]

SIR JAMES DEWAR, F.R.S., M.A., LL.D., D.SC.

SIR JAMES DEWAR, F.R.S., M.A., LL.D., D.Sc.

SIR JAMES DEWAR, co-inventor with Sir Frederick Abel of cordite, the smokeless powder used by the British Government, was born at Kincardine-on-Forth, September 20th, 1842. He received his scholastic training at the Dollar Academy and at the Edinburgh University. In 1863 he was appointed assistant to Lord Playfair, who at that period was Professor of Chemistry in the University of Edinburgh. He subsequently completed his studies at Ghent.

The scientific researches carried out by Sir James have won for him an honourable distinction. In 1891, on the occasion of the celebration of the centenary of Faraday's birth, at the Royal Institution, he gave some unique illustrations to demonstrate the peculiarities of liquid oxygen, and he subsequently experimented with a view to ascertaining its behaviour in the magnetic field. He had previously discovered that liquid oxygen did not moisten rock crystal, and, consequently, maintained a perfect spheroidal state when in contact with that substance. Some liquid oxygen, at a temperature of 180 deg. C., was placed in a shallow cup of rock crystal, and brought between the poles of Faraday's electromagnet. Upon the excitation of the magnet, the whole mass of liquid adhered to the poles, showing that oxygen, which is only feebly magnetic at ordinary temperatures, becomes at 180 deg. C. highly susceptible to magnetism.

In 1894, in recognition of his investigations of the properties of matter at lowest temperatures, he was awarded the Rumford Medal of the Royal Society. In conjunction with Professor Fleming, Sir James carried out researches dealing with the electric and magnetic properties of metals, and other bodies at low temperatures, and several years later, investigations for determining the dielectric constants of bodies at, and above, the temperature of liquid air.

He was elected President of the Chemical Society in 1897, and the next year he succeeded in obtaining 100 cc. of liquid air, thus establishing a fresh basis for further research. The Smithsonian Institution of Washington in 1899 awarded him the first Hodgkin's medal for his discoveries in the liquefaction of air.

In 1901 he delivered the Bakerian lecture to the Royal Society on the "Nadir of Temperature and Allied Problems." The following year he was elected President of the British Association. The Lavoisier gold medal was granted to Sir James Dewar in 1904, for his researches in liquefaction of gases, and in the same year the Gunning prize was awarded to him by the Royal Society of Edinburgh.

Sir James Dewar is an honorary member of the Institution of Civil Engineers; Professorial Fellow of St. Peter's College, Cambridge; Jacksonian Professor of Experimental Philosophy, Cambridge; Fullerian Professor of Chemistry, at the Royal Institution; and a director of the Davy-Faraday Research Laboratory. He received the honour of knighthood in 1904.

Thermometers and Pyrometers, with some of their Industrial Applications.

By Robert S. Whipple, Cambridge.

ALTHOUGH we are, perhaps, apt to laugh at the very rough methods adopted by our predecessors for the measurement of temperature, it cannot be denied that accurate temperature measurement is still a problem of considerable difficulty. Temperature is not a measureable quantity in the strict sense of the term. To measure a length or a mass is to count how many times it is necessary to take a given body chosen as a unit (metre or gramme, as the case may be) in order to obtain a system equivalent, either as to length or mass, of the body in question. The possibility of such a measurement assumes the existence of two laws—that of equality, and that of addition. Temperature obeys the first of these laws. Two bodies in temperature equilibrium with a third will also be in equilibrium with each other. The other law is entirely lacking. You cannot by placing together several bodies at one temperature realise a system equivalent from the point of view of exchange of heat, to a body at a different temperature.

GAS THERMOMETERS.

Many scales of temperature have been proposed, but the gas scale is the one now universally adopted, and readings obtained by any type of thermometer—electrical, expansion, or optical—are reduced to temperatures on the gas scale. The gas scale has been adopted as the standard scale of temperature—first, because gas of the same purity can be reproduced at any time; secondly, the dilation of the gas, which defines the scale of temperature, is sufficient for accurate measurement; and, thirdly, the scale is practically identical with the thermodynamic scale.

Although the scale of the gas thermometer has become the standard of reference, yet, fortunately, we are not compelled to use the gas thermometer in everyday life. We do not employ an elaborate gas thermometer (fig. 1), with its adjuncts of telescopes, microscopes, and standard barometer, every time we wish to measure a temperature, but we use a thermometer which has been carefully standardised at certain known temperatures. Thermometers, and with thermometers I include pyrometers, are generally standardised by means of fixed points of fusion and ebullition which have been determined by the gas thermometer.

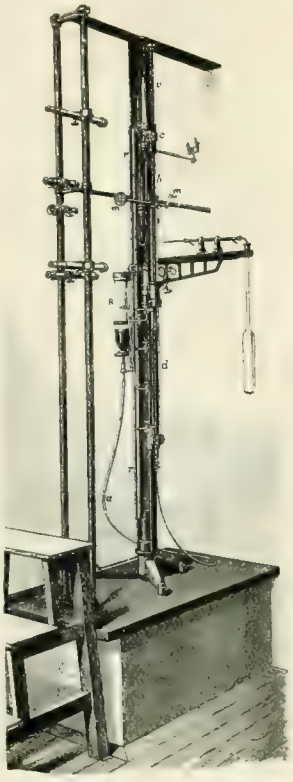


FIG. 1.

The illustration is taken from "La Convention du Mètre et la Bureau International des Poids et Mesures," p. 50, by Dr. Ch. Guillaume, and shows the small gas thermometer at the Bureau International des Poids et Mesures, Paris.

It is, perhaps, for this very reason that many of the discrepancies in high temperature thermometry have arisen. The actual precision of high temperature measurements depend on the accuracy to which these fixed points are known. It has at present been found

impossible to determine many of these directly on the gas thermometer, as even the platinum-iridium bulb of the gas thermometer becomes porous at extremely high temperatures. High temperature thermometry is badly handicapped through the scarcity of materials capable of being made into a thermometer bulb and of standing high temperatures. Platinum—the great stand-by—has been shown by Sainte-Claire-Deville and others, to be very permeable to hydrogen—a gas which is generally present where combustion is incomplete. Fortunately, platinum, even when red-hot, is practically impervious to all other gases; so that if nitrogen is employed as the gas whose volume we are measuring, and the platinum is suitably protected from hydrogen, accurate observation may be made. Porcelain must be glazed to ensure non-permeability, and the glaze cannot be considered impermeable above 1,100 deg. C. Water vapour passes comparatively rapidly through unglazed porcelain.

In passing, one cannot help being struck with the interdependence of all branches of scientific work. At first thoughts it would not occur to one that the accurate determination of the value of the metre would be the means of producing the most accurate thermometry the world has seen; yet so it has been. To determine the length of a standard bar it is essential that its temperature should be known accurately; to measure the temperature accurately the constants of the thermometer employed must be known to a high degree of precision, and these can only be obtained from an elaborate system of comparators, gas thermometers, etc. Thus the preliminary work on the measurement of the metre produced the masterly work of Dr. Ch. Guillaume on the mercury thermometer and his valuable treatise "Thermométrie de Précision."

I cannot here enter into the details of the construction and working of a gas-thermometer, and would refer those who are specially interested to Dr. Guillaume's book previously mentioned, or to Dr. Burgess's translation of M. Le Chatelier's book, "High Temperature Measurements." I must acknowledge my indebtedness to the latter book for some of the facts mentioned in this article.

TYPES OF THERMOMETERS.

As previously stated, the gas-thermometer, although invaluable from the strictly scientific point of view, is practically useless as a tool in everyday life. It will be well, therefore, to summarise roughly the various means of measuring temperature in general use, and to then treat these methods more fully in detail with their particular applications.

TYPES OF THERMOMETERS IN GENERAL USE.

—		Type.	Range in Deg. Cent. over which they can be used
Expansion.	Those depending on the change in volume or length of a body with temperature.	Gas	0 to 1000
		Flow of air	0° to 1600°
		Mercury (Jena glass and nitrogen)	−40 to 500
		Spirit	−100 to + 10
		Unequal expansion of metal rods.	0° to 500
		Contraction of porcelain.	0 to 1800
Thermo-electric.	Those depending on the electromotive force developed by the difference in temperature of two similar thermo-electric junctions opposed to one another.	Galvanometric	0 to 1600
		Potentiometric.	0° to 1600°
Electric Resistance.	Those utilising the increase in electric resistance of a wire with temperature.	Direct reading on Indicator	0 to 1400
		Bridge and galvanometer	0° to 1400
Radiation.	Those depending on the heat radiated by hot bodies.	Radio-micrometer	0° to 10,000°
		Bolometer	0° to 10,000°
Optical.	Those utilising the change in the brightness or in the wavelength of the light emitted by an incandescent body.	Incandescent filament in telescope	0° to 2000°
		Nicol with quartz plate and analyser.	0° to 2000
Calorimetric.	Those depending on the specific heat of a body raised to a high temperature.	Copper or platinum ball with water vessel.	0° to 1500°
Fusion.	Those depending on the unequal fusibility of various metals or earthenware blocks of varied composition.	Alloys of various fusibilities.	0° to 1980°

Dr. Chree, in some valuable Notes on Thermometry, published in the Philosophical Magazine for March, 1898, makes the statement that "the ideal mercury thermometer is one which accommodates itself at once and completely to the temperature it is for the time being exposed to, and which, when exposed to a given temperature, supplies an invariable reading." I think there could not be a better definition of what is required from any form of thermometer.

EXPANSION THERMOMETERS.

Although the gas thermometer is essentially an expansion instrument, we will pass at once to the mercury in glass thermometer as being the expansion instrument par excellence. Many of us know how far the mercury thermometer, as generally used, falls short of Dr. Chree's ideal, but I think few of us realise how near Dr. Guillaume has brought us to that ideal. It is now possible, thanks to his work, to measure temperature with a mercury thermometer, with an accuracy of 0·001 deg. C.

It is sad to think how far we in England have been behind French and German practice in the construction of accurate mercury thermometers; more especially when it is borne in mind that Kew standards, as made under the direction of Balfour Stewart and Welsh, were for many years the standards of the world. I can only account for it by the fact that we were standing still whilst the National Physical Laboratories of France and Germany were developing the construction and materials of their thermometers. With our own National Physical Laboratory, now well established under the able direction of Dr. Glazebrook, we are not likely to fall behind again. We will now consider briefly the various errors found in a mercury thermometer of the best construction, and the methods of determining the corrections to allow for them.

Fig. 2 illustrates a collection of standard mercury thermometers as designed by the Bureau International des Poids et Mesures.

CORRECTION FOR PARALLAX AND REFRACTION IN MERCURY THERMOMETERS.

The divisions of the scale on the stem of a thermometer are not exactly adjacent to the mercury thread, and consequently the readings

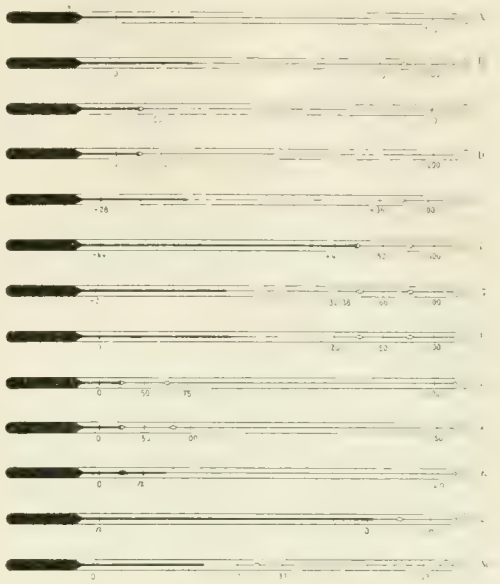


FIG. 2.

will vary somewhat with the direction of the line of sight. This error is best eliminated by taking the mean of the readings when the scale is on the side nearest the observer, and again when placed opposite. Unfortunately, this necessitates doing away with the enamel back in the case of very accurate thermometers.

SCALE AND CALIBRATION CORRECTIONS.

It is impossible to obtain a tube or stem of absolutey uniform bore. It follows, therefore, that the size of a degree division must vary throughout the tube. The error arising from this inequality in the bore can be accurately determined by measuring the length of a small thread of mercury in scale divisions in various portions of the stem.

DETERMINATION OF BOILING POINT.

Care must be taken in the determination of this point, the whole thermometer being

enveloped in steam, which is allowed to pass freely into the open air. It is important that the barometer reading should be determined accurately, a difference of ·14 millimetre in height of the barometer making a difference of 0·005 deg. C. in the boiling point.*

DETERMINATION OF FREEZING POINT.

The stem as well as the bulb of the thermometer should be in finely-chopped ice, which should be as pure as possible.

CORRECTIONS FOR DIFFERENT TEMPERATURE OF SCALE OR STEM.

In the case of thermometers with brass scales in which the bulb, scale, and stem have different temperature co-efficients of expansion, large errors may be introduced by not correcting the scales for temperature. In accurate thermometers the same correction has to be applied to the glass scale. Errors amounting to a quarter of a degree may be introduced by not allowing for the expansion of the mercury thread in the capillary bore.†

CORRECTION FOR PRESSURE ON THE BULB.

There is an external and internal pressure of the thin glass of the bulb. At high elevations above sea level, when the atmospheric pressure is reduced, the error introduced becomes of importance; but for general use it may be neglected.

In long-stem thermometers the error introduced by using horizontally a thermometer which has been calibrated vertically, becomes of importance. I once examined a mercury thermometer about 9 ft. long, in which the error introduced by using the thermometer horizontally amounted to 30 deg.

An expansion thermometer of general interest is the one in which temperature is measured by the unequal expansion of two materials, such as steel and porcelain or graphite.

A graphite rod is placed at the bottom of a closed steel tube, a small steel tube being connected to the upper end of the graphite rod. By means of various simple mechanical movements the differential expansion of the two rods is indicated on a dial. These thermometers are useful up to temperatures of about 1,200 deg. F. The corrections to two of these graphite thermometers are plotted in fig. 3, the temperature when they become unreliable being clearly shown.

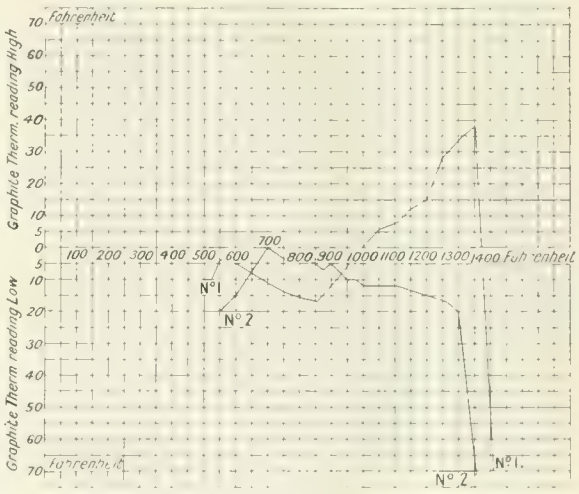


FIG. 3. RESULTS OF TESTS OF TWO GRAPHITE THERMOMETERS.

The Uhling pyrometer always impresses me as being one of the most ingenious yet constructed. Knowing as I do something of the difficulties that a new invention entails, I feel that Mr. Uhling must be warmly congratulated on the ingenuity expended in developing his idea and on the success obtained by his pyrometer. As I have had no practical experience with this pyrometer, however, I do not like to discuss it in detail.

(*To be continued.*)

* Wiss Abhandl. der Phys.-Tech. Reichsanstalt, Vol. I., p. 102.

† Modern Meteorology, F. Waldo 1893 p. 42.

A paper read before the Cleveland Institution of Engineers, Middlesbrough.

THE INSTITUTION OF MECHANICAL ENGINEERS.

PROGRESS AND WORK DURING 1904.

AT the annual meeting of the above Institution this evening a very satisfactory report dealing with the work accomplished during the past year will be presented. The following is an abstract :

MEMBERSHIP ROLL.

The total number on the roll of the Institution at the end of 1904 was 4,477, which, as compared with 4,211 at the end of the previous year, shows a net gain of 266. During the past year 460 candidates were elected, of whom 47 were formerly graduates, and two elections became void, thus making 411 names added to the register. The total deductions have been 145, made up of 50 deceases during 1903, 59 resignations which took effect on January 1st, 1904, and 36 removals.

FIFTY-FOUR DECEASES.

Fifty-four deceases of members were reported during 1904, including Sir Lowthian Bell, elected 1858; Mr. F. Rouse, Peterborough, elected 1856; Mr. J. W. Bower, Leamington Spa, elected 1858; Mr. J. B. Howell, Sheffield, elected 1861 : Mr. A. Fry, Bristol (deceased, 1903); Mr. C. J. Galloway, Manchester, and Mr. T. Holcroft, Bilstow, elected in 1866. The Council place on record their great regret at the loss of H.R.H. the Duke of Cambridge, who became an honorary member in 1892.

REVENUE.

The total revenue for the year 1904 was £11,049 10s.2d, while the expenditure was £10,406 0s. 8d., leaving a balance of revenue over expenditure of £643 9s. 6d., exclusive of entrance fees £472 and life compositions £139 carried direct to capital account, and exclusive of the value of subscriptions in arrear. The financial position of the Institution at the end of the year as shown by the balance-sheet: The total investments and other assets amount to £72,175 0s. 3d., and, deducting therefrom the £25,000 of debentures and the total remaining liabilities, £2,018 15s. 5d., the capital of the Institution amounts to £45,156 4s. 10d.

STEAM ENGINE RESEARCH.

The first report by Professor David S. Capper, to the Steam-Engine Research Committee, of which Mr. William H. Maw is chairman, has now been completed, and, together with a preliminary report on progressive speed and pressure trials carried out previous to March, 1896, will be presented at the March meeting. The question as to whether this research should be continued, and in what direction will be considered after the discussion on the present report.

ALLOYS RESEARCH COMMITTEE.

Since the presentation in January, 1904, of the late Sir William Roberts-Austen's last report, the Alloys Research Committee, under the chairmanship of Sir William H. White, has continued its work at the National Physical Laboratory. Dr. Glazebrook, Director of the Laboratory, has arranged a series of investigations on specimens of nickel steel presented by Mr. R. A. Hadfield, a member of the committee. It is anticipated that a further report will be presented this year by the Committee, communicating the results of these researches. The names of Professor J. O. Arnold, Dr. A. Barr, Mr. F. W. Harbord, and Mr. J. E. Stead, have been added to the committee. Further investigations having great practical importance are now being considered.

GAS ENGINE RESEARCH.

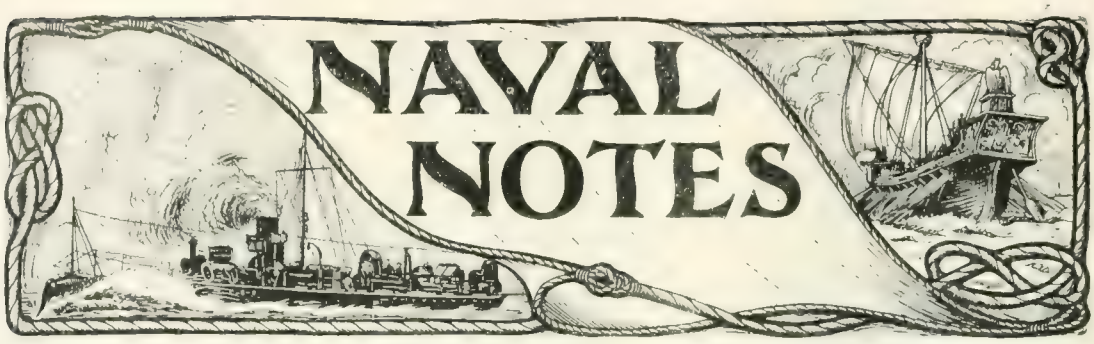
Professor F. W. Burstall reports that the two specially constructed large gas-engines and a gas holder erected in the new power house of the Birmingham University are now available for the Gas-Engine Research Committee's experiments. A scheme of experiments, indicating the methods of working, is under consideration, and it is hoped that the next report will be ready for presentation at the opening of next session. A generous gift of £100 towards the expenses of carrying on the research has been received from Dr. Ludwig Mond, F.R.S. The name of Captain H. Riall Sankey has been added to the committee, of which Dr. A. B. W. Kennedy is chairman.

INITIAL CONDENSATION IN STEAM CYLINDERS.

The experiments on initial condensation in steam cylinders, which Professor T. Hudson Beare, reporter to the Committee on the Value of the Steam Jacket, is carrying out with special apparatus for the purpose, are in active progress, but are still incomplete. The results obtained so far, however, justify the hope that the Committee, under the chairmanship of Mr. Henry Davey, will be able to present, during the year 1905, an interim report dealing with the results obtained in the experiments on non-jacketed cylinders.

THE SUMMER MEETING.

It is intended to hold the next Summer Meeting in Belgium, in view of the International Exhibition to be held at Liége in 1905.



WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.

GREAT BRITAIN.

THE past week has been a busy one in commissionings for the British Navy, the *King Edward VII.*, the *Sapphire* and the *Diamond* having all hoisted the pennant for the first time. The *King Edward VII.* becomes flagship of Vice-Admiral (acting) Sir William May, who takes over command of the Atlantic Fleet on March 1st, from Lord Charles Beresford. The *Sapphire* is the flagship of Rear-Admiral Winsloe, commanding the torpedo craft and submarine flotillas *vice* the *Halcyon*, and the *Diamond* has gone to the North American station.

The repairing vessels *Erebus* and *Fisgard*, which were but recently allocated to the services of the Portland and Harwich destroyers have now been withdrawn from those duties and are to be employed for the instruction of boy artificiers. Considerable changes are indeed in course of evolution in regard to the destroyer flotillas and the sea-going depot ships attached to each flotilla. These changes are complementary to the redistribution scheme of last December and like that scheme will result in increasing the war-readiness of the fleet.

The scout *Skirmisher* was launched at Barrow, on February 7th and two more submarines of the A class took the water on the 9th at the same yard.

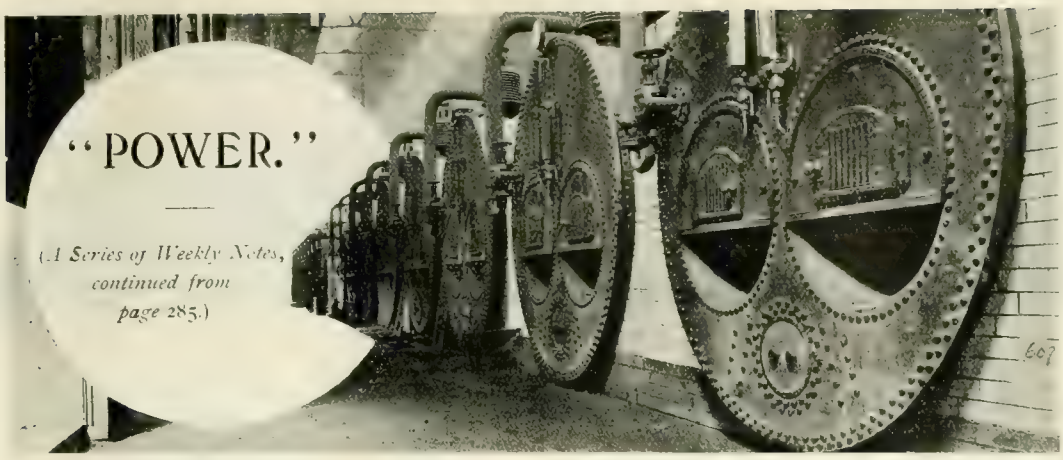
The cruise of the ships in commission in reserve at Devonport, under command of Read-Admiral C. S. Robinson, this week is a remarkable proof of the thoroughness which has characterised the new scheme of distribution and mobilisation. Up to the beginning of last month the vessels composing this squadron, with one or two exceptions, were laid up in the basins, and were only kept in working order by occasional visits from small bodies of dockyard workmen, who would not of course have formed part of the crew had the vessels been commissioned hastily for service in an emergency. Now, however, the vessels are continually manned by all the more expert ratings, a fair proportion of their officers live on board, and the result is that the vessels are fit to take the sea and offer battle with a few hours' notice from the Admiralty to bring their complements up to full strength. Those who remember the breakdowns and discomforts incidental to the commissioning of reserve ships for the manœuvres in past years will realise the enormous gain to the Fleet in battle-worthiness by the new arrangement.

GERMANY.

The total of the German Navy estimates for 1905 is £11,610,000 (M. 232,200,000). This includes a vote for construction which is subdivided to allow for the completion of the battleships *Hessen* and *Preussen*, the armoured cruiser *York*, and the small cruisers *Munchen* and *Lubeck*, and for the commencement of the two battleships *Q* and *R*, of the *Deutschland* class, the armoured cruiser *D*, the small cruisers *O*, *Ersatz Wacht*, and *Ersatz Blitz*, and two gunboats. There is a charge of a million and a half marks for submarines to be purchased. The personnel is to be increased by one hundred officers, including one vice-admiral, two rear admirals, and four captains.

UNITED STATES.

The contracts for the armour plate for the new American vessels have been awarded to the Carnegie and Bethlehem Companies. Although the Midvale Company, which secured last year's contract made a lower bid than the two other companies, it was not judged expedient to give more work to the new firm until it has demonstrated its ability to carry through the work already in hand.



In an experiment with a cubical metal box, internally heated and submerged in water, it was found that steam was generated from its upper surface more than twice as fast per unit of area than from its vertical sides and that the bottom surface generated no steam at all. These differences are owing to the difficulty with which steam separates from a vertical surface to give place to fresh charges of water, and to the impossibility of its escape from an inverted surface.

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The box was also placed in an inclined position, when the elevated side permitted the steam to escape much more readily, and the rate of evaporation was increased; while on the depressed side the steam hung so sluggishly as to cause the metal to become overheated. It appears from this that in locomotive boilers the sides of the firebox should be inclined for the better escape of the steam bubbles upwards.

It is thus evident that in any steam boiler there are various qualities of heating surface, and that when we say of a boiler that it contains so many square feet of surface, we are speaking of a total whose constituent parts differ enormously in efficiency. For example, in locomotive, or in loco-type, boilers—for there is a distinction between these terms about which we shall have something to say presently, there is no doubt that the firebox heating surface, so far as steam-making is concerned, is worth all the rest put together. The first twelve inches of tube surface, again, makes more steam than all the remainder of the tube length, and so on, very nearly, the last portion of tube surface being of little actual value. Thus we might have two locomotive boilers with the same tube surface, yet of vastly different steaming powers. If we have two boilers, one with 1,000 square feet of tube surface, the tubes being 7 ft. 6 in. long, and another with 2,000 ft. of tube surface, with 15 ft. tubes, other conditions being equal, the steaming power of the last-named boiler will not be 10 per cent. better than that of the former. But if we double the number of the 7 ft. 6 in. tubes, instead of doubling their length, then, indeed, if the products of combustion be sufficient to fill and traverse the tubes, the power of the boiler will be nearly doubled, because the number of first feet of tube is doubled. Of course, the tube-length in a locomotive-engine boiler is a function of the general design of the engine, and the boiler, both in length and diameter of barrel is limited by structural considerations, which have nothing to do with steam making.

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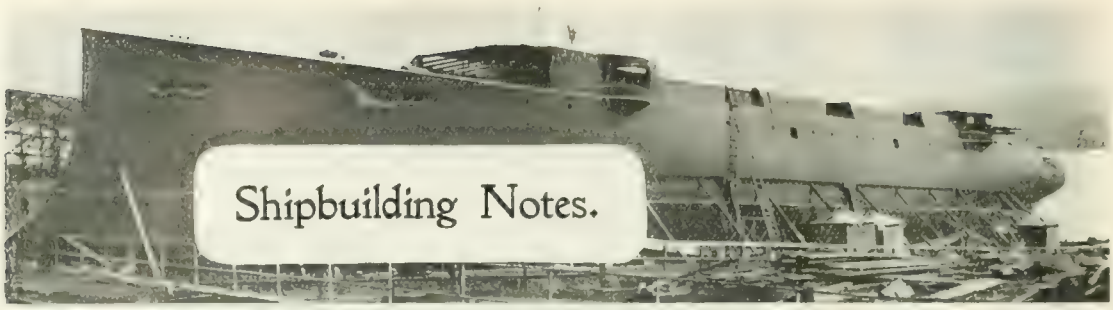
Again, long tubes require a sharper blast than short ones to maintain the draught, because there is more frictional resistance; directly, as the increase in length of tube, and indirectly because the long tube fouls, or becomes coated with soot more rapidly than a short one. Under certain conditions, as when the boiler is forced, heavily fired, with a strong blast, the velocity with which the gases are drawn through the tube may have the effect of making the second foot in length nearly equal to the first in value. The true measure of the boiler power is the grate area; and now, after many years of "piloting," or in effect doubling the grate area by the expedient of hitching on a second engine, we have passed into the era of gigantic boilers, limited, apparently, in diameter, only by the loading gauge, with such marked success, that the only wonder is that we have stuck so long to the idea that any amount of tube surface would make up for deficient firebox and grate area.



Shipbuilding Notes.

A STEAMER IN SECTIONS FOR PERU.

The steamer *Grange Branch* sailed from Hull on Saturday, January 28th, for Mollendo, South America, with the entire hull, machinery, and outfit of the s.s. *Inca* (built by Earle's Shipbuilding and Engineering Company, Ltd., Hull), which is intended for service on Lake Titicaca, situated high amongst the mountains of Peru.

There is nothing new in the construction and shipment of small vessels in pieces for re-erection in foreign parts, but not often has work of this description been carried out on such a large scale.

The *Inca* will carry about 550 tons dead-weight. Her dimensions are 226 ft. by 30 ft. by 14 ft., and she is propelled by twin screw engines of 1,000 h.p., and will have a speed of 12 knots.

The fact that the whole of the work has had to be erected and then taken to pieces has necessarily involved special precautions being adopted to ensure the shape of the structure being maintained up to the point of taking down. The saloons, staterooms, pantries, etc., were all built up in the joiners' shop, a portion of this building having been prepared to represent the dock of the vessel, and this section of the work was completed in practically all its details, including upholstery, curtains, rods, dining tables, etc., as well as an installation of steam heating. The leads of wires for the electric light, position of switches, and all other details were marked on the cabin sides. The auxiliary machinery, fans for forced draught, with pipes and connections were all fitted up on the ship.

In addition to the structural portions and fixed parts of the internal arrangements, the materials include a variety of incidental fittings, such as bolts, nuts, rivets, screws, etc. There were over three thousand separate packages, each of which required a separate mark of identification for those who will have to undertake the re-erection; there are also separate marks for shipment purposes.

The question of transport is not by any means an easy one at the port of Mollendo. The barges or lighters which convey the material from the steamer in the open roadstead are subject to a heavy ground swell from the Pacific, which renders the unloading an operation of considerable risk to those engaged in the work. From the port, to the site of re-erection on Lake Titicaca, which is situated between the ranges of the Andes, the sections, etc., have to be conveyed by rail a distance of about 150 miles. The railway which runs along the mountain sides and across valleys, is a remarkable work of engineering, and rises in the 150 miles to an altitude of over 12,000 feet.

The site of erection is also interesting, and it is said represents the cradle of the ancient Inca races. Notwithstanding the novelty of construction, which caused large portions of the ship to be left in a very incomplete condition owing to the absence of fastenings, and also to the risk of taking to pieces such an intricate structure, the whole of the work was carried out practically without accident to those engaged.

LAUNCHES.

Messrs. Archibald McMillan and Son, Ltd., shipbuilders, of Dumbarton, have just launched the steel screw steamer *Osprey*, built to the order of Mr. Hugh Flinn, of Liverpool. The dimensions are as follows: Length between perpendiculars, 140 ft., breadth, 23 ft. 6 in., depth, 10 ft. 9 in. The vessel is designed to carry a deadweight of 360 tons, and is fitted with raised quarter deck and topgallant forecastle. Machinery for a speed of ten knots is being supplied by Messrs. McKie and Baxter, Glasgow. The vessel and machinery have been built to Lloyd's highest class, and under the superintendence of Mr. A. J. Maginnis, of Liverpool. The christening ceremony was performed by Miss Flinn, daughter of the owner.

H.M.S. *Kennet* is the first vessel to be completed by the Thorneycroft Company at their Woolston Works, Southampton. She is 225 ft. in length, by 23 ft. 10½ in. beam, with extreme draft of 9 ft. 6 in., and a normal displacement of about 580 tons.

RUNNING-SHED NOTES.

III.—By J. C. R. Adams.

There is another kind of brake with which some engines are fitted, all unsuspectingly by the makers, but which nevertheless exercises a considerable effect in absorbing power. I mean the piston rings. The construction of the piston rings is too large a question to enter upon here, but the ill-effects of a tightly-fitting spring plug which has to be driven by the unfortunate engine through four or five hnndred feet of cylinder per minute may be easily imagined.

If there is reason to suspect a piston of being too tight, it may be put to the proof by laying the hand upon the connecting-rod after the steam has been shut off, and while the engine is still revolving by the momentum of the flywheel. The lag or drag of the piston will then be distinctly felt at each end of the stroke. This is also the best time for detecting slack connecting-rod brasses, as, owing to there being no compression or cushioning action of the steam the reversal of motion in the reciprocating parts gives both audible and tangible evidence of any lost motion in their joints. Conversely, the instant of starting is the psychological moment for testing the touch by adjustment of the main or crank-shaft bearings.

We now come to the testing of the slide valves and pistons, both for adjustment, and for steam-tightness. In single slide-valve engines, whether with one or two cylinders, if the slide valves and cylinder faces are accurately made to dimensions, the valves can be set by observing the "beats" of the exhaust steam, with a sufficient approximation to accuracy. For instance, if the exhaust beat sounds heaviest when the cross head is at its furthest from the cylinder, then there is too much steam admitted at the back end of the cylinder, and the valve rod must be adjusted by slightly lengthening, by whatever means of adjustment are provided. If too much steam be admitted at the front end, then the valve rod is too long and must be shortened. A driver, with a well-attuned ear, can set a valve in a minute or two in this way, so that an indicator diagram taken afterwards will show an almost exact balancing of the two sides of the piston.

If there is an expansion valve working on the back of the main slide valve, and no indicator is at hand, the valves may be adjusted—provided the eccentrics are properly placed—by temporarily removing the expansion-valve, and setting the main slide "by the lead," that is adjusting the main valve-rod for length by observing the positions of the valve when the crank is on the dead centres, and equalising the openings for each end of the cylinder. The expansion valve being then put in place, and the cover put on the steam chest, the engine may be started and the expansion valve set "by ear" as above described. But in the running shed, the indicator is always used in valve-setting, if there is anything beyond a plain slide-valve to be dealt with.

To test the steam-tightness of the valves and pistons, which should not be done until the engine has been running for a few hours, in order to allow them to "come up to a face"—we may proceed as follows: Set the crank on each of the dead centres successively (in a single-cylinder engine), and turn the steam on suddenly. If the exhaust nozzle is accessible, and no steam is seen to escape with the crank on either dead centre, it may be taken for granted that both slide valve and piston are tight. Should steam appear, a valve leakage may be distinguished from a blowing piston, by turning the crank round until the cut-off point is passed, in which position the slide valve will entirely cover the steam ports. If no steam passes now, the leakage may be confidently ascribed to the piston. Many slide valves, from their form have a tendency to "buckle" or arch themselves, when hot, so that a valve which is a perfect fit all over its surface when cold, will bear only upon the two ends when heated up to its working temperature. So well is this understood that it is a common practice to allow for it in surfacing the valve, by scraping the ends so that they do not touch the surface-place, when cold.

In a double cylinder engine, if fitted with reversible eccentric sheaves, the simplest way of testing the valves and pistons is to set one of the valve eccentrics "to run backwards." The engine is then "hove to," as a sailor would say. and can neither turn one way nor the other, in which condition it is of course, perfectly tractable, and may be placed in almost any required position for valve testing and observation.

In a compound engine the high-pressure piston and valves may be tested by the pressure-gauge on the receiver, if one be fitted, which will show at once if pressure is accummulating in the low-pressure valve chest through leakage in the high-pressure valves or piston. The low-pressure side in its turn may be set on its dead centres, and steam admitted direct by the by-pass valve to the low-pressure steam chest. from which it will escape through the exhaust pipe to the atmosphere, in case of leakage through valve or piston.

ELECTRIC POWER IN COLLIERIES.

At the last meeting of the Rugby Engineering Society, on February 2nd, Mr. G. M. Brown, B.Sc., read a paper on this subject. The following is an abstract of the main features of the paper :—

The greatest advance in the application of electricity for mining purposes has been due to the introduction of the polyphase alternating current induction motor. One of the chief advantages of alternating current plant for mining work lies, of course, in the fact that all the switches can be of the oil-break type, and the use of fuses is not necessary. The author is not aware that the results of any experiments on the behaviour of this type of switch, when used with direct current, have yet been published. When used on alternating current circuits, they will operate perfectly under the most trying conditions ; but when used on direct current circuits, there is considerable carbonisation of the oil every time the circuit is opened with a heavy current. This is no doubt due to the fact that on alternating current circuits there is no electrolytic action, and any arc formed between the switch-blade and contacts is extinguished at the instant when the current passes through zero, whereas when used on a direct current circuit, the full amount of energy which can be stored in the circuit is to be dissipated in the switch.

TYPES OF GENERATING PLANT.

With regard to the generating plant which must be installed, unless power is to be taken from the mains of a supply company, it is necessary to decide the voltage and periodicity which will best meet the circumstances of the case, for the nature of the current is practically decided by consideration of the relative advantages and efficiencies of two-phase and three phase induction motors. Thanks to the labours of the recent commission on the standardisation of electrical machinery, there are practically only two periodicities to consider, viz., 25 and 50 complete cycles per second.

VOLTAGE AND PERIODICITY.

With regard to both voltage and periodicity, it is impossible to lay down any definite rules, and a conclusion can only be arrived at after careful consideration of the case in hand. In general, when there are a large number of slow speed motors of high power, say for driving reciprocating pumps, and large haulage gears, or main winding gear, it will be desirable to select 25 cycles and voltage according to amount of power and distance it has to be transmitted, for large 25 cycle motors have better constants that 50 cycle motors. If, on the other hand, there is much pumping to do, and it is decided to use high-lift centrifugal pumps, which require motors running at high speeds, it will be more satisfactory to select 50 cycles. If the plant is small, and there are no very large motors, 50 cycles will be the better periodicity, and will allow of both arc and incandescent lighting as well as much greater choice of speeds for the motors.

The voltage to be selected depends not so much on the size of the motors, as on the amount of power to be transmitted to various points, and their distance from the generating station. In ordinary cases where the generating plant is situated close to the mouth of the shaft, and most of the power is required near the bottom of the shaft, it will be advisable to fix on 500–550 volts as the most economical.

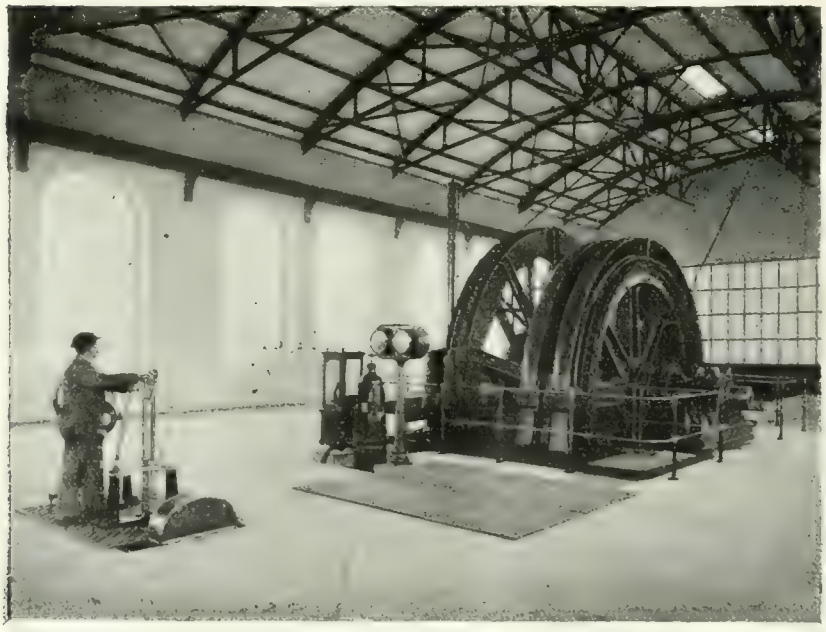


FIG. I.—ELECTRIC WINDING ENGINE, PREUSSEN PIT II.

ELECTRICAL WINDING GEARS.

At present there are no very large winding gears electrically driven in this country, and although a great many have been installed on the Continent, there are none of the capacity of some of the steam winding engines at our larger British collieries, a condition of affairs which has caused some mining engineers to conclude that it is impossible to wind as much coal from a shaft in a given time electrically as by steam power. On investigating the problem, it would, however, appear that the difficulties are of such a character that they are likely to be overcome in the immediate future.

A good example of this type of plant is that installed at the Zeche Matthias Stinnes, Carnap, Westphalia, which is capable of dealing with 100 tons per hour and winds from a depth of 437 fathoms. The winding gear is driven by two motors directly coupled to Koepe pulley, 19 ft. 8 in. diameter, running at forty-one revolutions per minute. In the case of large winding gears connected to a power station, situated very near the shaft, the most promising and most economical plan seems to be the installation of a separate engine and dynamo for supplying current to the winding gear motors. In this country winding engines have occasionally to deal with 750 tons per hour from depths up to 800 fathoms. Figs. 1 and 2 illustrate a winding engine plant at the Preussen Collieries, Westphalia.

PUMPS IN MINES.

One of the principal applications for electricity in mines is to the driving of pumps. At the present time it is possible to obtain reciprocating pumps of the Express, or high-speed type, having very much higher efficiencies and running at such speeds that reduction gearing may be dispensed with, and the motor mounted directly on the crank shaft. The speeds of such pumps range from 160 to 300 revolutions per minute, and their efficiencies may be from 75 per cent. to 85 per cent., according to size, the latter figure referring, of course, to the largest size. One of the most notable installations is that of the Zeche Viktor, where there are two pumps on the lower level which deliver 1,500 gal. per minute to a height of 1,700 ft. The guaranteed combined efficiency is 58 per cent., but from actual tests the efficiency of the whole plant, including generators, is 63 per cent., and the efficiency of the pumps alone 77 per cent.

A general meeting of the Mining Institute of Scotland was held on February 8th, at Glasgow. During the afternoon of that day a large number of the members visited the works of Messrs. Mavor and Coulson, Ltd., Mile End, Glasgow, where there was a demonstration of electrical coal cutting appliances.

At the evening meeting Mr. E. O. Forster Brown contributed a paper on "The Application of Electrica Power at Mines in Germany. "He said that Westphalial had of late made the greatest strides in experimenting with and applying electricity in various ways for mining purposes, although the natural conditions prevailing there appeared to be scarcely so favourable for its adoption as in Silesia. The system of current used for general purposes at all of the newer plants with rare exceptions, was three-phase. The purpose to which electricity was chiefly applied were, in relative importance, as follows: Pumping, ventilation, winding, hauling, coal-cutting and air-compressing. The author gave a description of the electric installations at the principal German collieries.

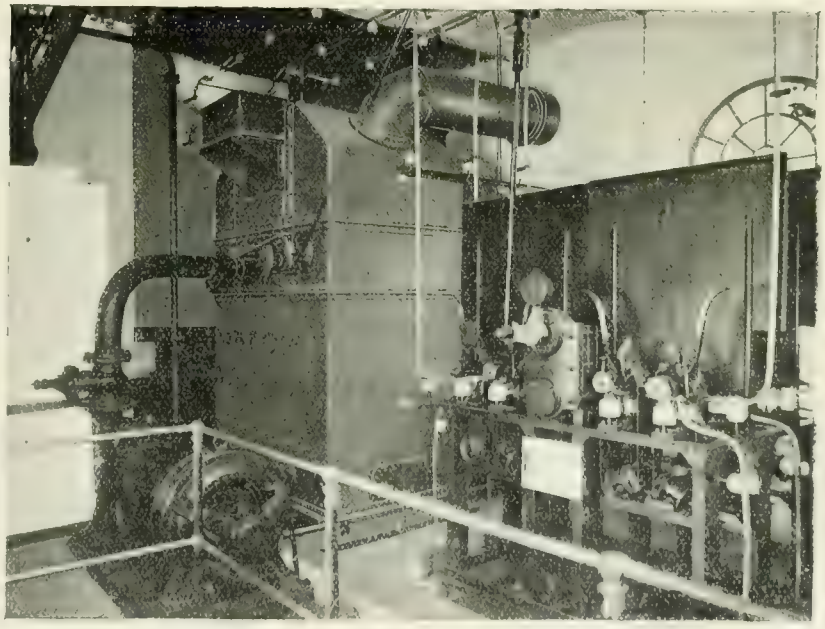


FIG. 2.—CONTROLLER AND SWITCHGEAR FOR WINDING ENGINE, PREUSSEN PIT II.

COAL MINING PROBLEMS.

At the last meeting of the North of England Institute of Mining and Mechanical Engineers, Mr. W. C. Blackett presiding, Mr. E. H. Robertson read a paper on "The action, influence and control of the roof in Longwall Working." The author said that this subject embraced such problems as the protection of miners at the coal-face, of putters and ponies in the gateways from accidents caused by falls of stone, and, on a more comprehensive scale, the laying out of the workings in such a way as to ensure the upkeep of airways and waterways in the waste at the least possible trouble and expense, and to prevent the coal being unduly crushed as the weight of the roof comes on, while at the same time utilising the roof weight to assist the hewers at the face in the working of the coal. The methods by which these problems were to be solved differed greatly, being dependent on the relative hardness of the coal, the roof, and the floor, and on the depth, thickness and inclination of the seam. The writer gives examples of longwall working in six seams under these various conditions, and states that the principal factor in ensuring a safe and gradual subsidence of the roof of a longwall gateway is careful packing. Generally speaking the roof has little influence on the coal in working to the dip as compared with that when working to the rise.

"Water-sprayed or damped air in Coal Mines," was the subject of a paper by Mr. James Ashworth, who referred to the opinions of several of H.M. Inspectors of Mines, the majority of whom apparently placed high value on watering as a preventive and also as a restrictive agent against the extension of an explosion of coal dust. The paper goes into considerable detail as to temperatures and percentages of saturation. Reference is made to the continual presence of fine dust (due to the transit of coal) floating in the air mixed with moisture, and the writer states that as no percentage of moisture, under 5 per cent. can restrain a coal-dust explosion, it is not surprising that in the disasters at Tylorstown, Universal and MacLaren collieries, the flame swept along the watered parts of the road as if they were charged with gas. Experiments made in Germany supported this view, as they proved that water had no restraining influence on an explosion of coal dust, unless the dust was so wet that water could be squeezed out of it by the hand. It was useless therefore to depend on watersprays for restraining the extension of an explosion after it is once initiated. The paper deals with the danger of extending ankylostomiasis by watering underground and, in summing up the contrary interests involved, asks: (1) shall we attempt the impossible task of limiting a possible explosion, or (2) shall we give attention to the comfort and health of underground labour and reduce spraying to a sanitary point."

In the discussion which followed, a suggestion was made that oil might be used with advantage in laying coal dust.

Mr. J. B. Atkinson, H.M. Inspector, said the addition of salt to the water would be more in the right direction, and it might be worth while to try and send air into the mine at considerably above the normal temperature with a view to its depositing moisture as it went round the workings. The chemical aspect of the question was also raised.

Mr. J. P. Kirkup said that watering deep mines would render them intolerably oppressive, and Mr. C. H. Merivale, in confirming this, mentioned some Belgian mines where watering was discontinued so that the workmen could be kept cool and in a fit state to work.

ELECTRICAL EQUIPMENT OF AUTOMOBILES.

A paper on the subject was read before the Manchester Section of the Institution of Electrical Engineers at the last meeting by Mr. H. V. Mahler. The following is an abstract.

The author's object is to explain the different methods of producing electric ignition. He deals first with the high tension system, and devotes particular attention to the contact breaker, which serves the purpose of starting and stopping the current in the primary coil at the right instant, so as to produce the spark. In many systems a separate coil is required for each cylinder, but a system has been introduced by Mr. S. F. Edge, whereby one coil will do the work for any number of cylinders. A similar system is employed on the new 15-h.p. four cylinder De Dion motor. In this case, the cam is made with four projections instead of one, and this causes the blade to make contact with the platinum-pointed screw four times in one revolution of the half-time shaft, and so operates the single trembler coil equally four times in the same period of time. The

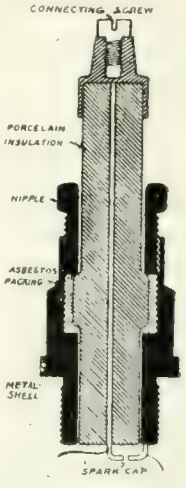


FIG. 1.
SPARKING PLUG.

production of four-spark discharges at regular intervals of time from the coil are thus obtained, but of course these have to be distributed to the four cylinders of the engine in proper sequence.

It will be evident that the service of high-tension current to the cylinder is made with the utmost regularity, without any interference from the advance and retardation of the ignition, which is obtained in the usual simple way by partially rotating the primary current contact-breaker on its boss round the half-time shaft.

The author also refers to the Garrard-Maxfield contact breaker, which is an abnormally quick contact breaker, and which has only lately been put on the market. This contact breaker, fig. 2, has two plunger rods, both controlled by spiral springs. Where these meet in the centre of the socket they are tipped with platinum. The upper plunger is insulated from the lower plunger by means of a fibre bushing The electric wire is attached to the upper plunger. In action, when the cam piece comes round, it forces the contacts hard together in opposition to the spring tension, so that when the lower plunger is released, the springs cause the platinum to separate with an extremely sharp action, thus causing an intense spark at the plug even at the highest speeds.

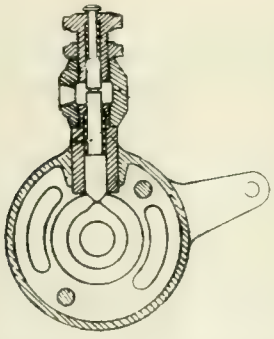


FIG. 2.—GARRARD-MAXFIELD CONTACT-BREAKER, WITH COVER REMOVED SHOWING SPRINGS AND PLUNGERS.

The author also deals with the subject of magnetic ignition. The advantages of the system are: The absence of accumulators and coil; there is no recharging required; freedom from breakdown through leakage or short circuit; and certainty of ignition at high speeds.

MAGNETIC IGNITION.

The most generally adopted and easiest system of magnetic ignition is the Eisemann system. In this system the armature rotates and gives a low-tension current. On this dynamo there is a make and break. The low tension current is taken into an induction coil and then transformed into a high tension current in the usual accumulator and coil system. The armature is generally driven from the engine shaft by a chain and the current is collected from two contact rings and brushes. From one of these brushes it passes into the primary winding of the coil, and returns back to the other brush from the coil, and through an interrupter

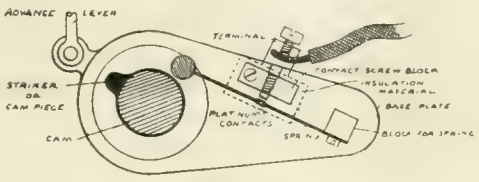


FIG. 3.—POSITIVE "MAKE" CONTACT-BREAKER.

on the armature shaft. On this system an ordinary sparking plug is used. It will, therefore, be readily seen that in the case of break down of the dynamo the accumulator and coil system can easily be adopted. The spark is advanced and retarded simply by altering the position of the make and break on the dynamo shaft. This system will spark at a very slow speed, and works well under all possible conditions met with. In fact, this is without doubt the leading and most commonly used system.

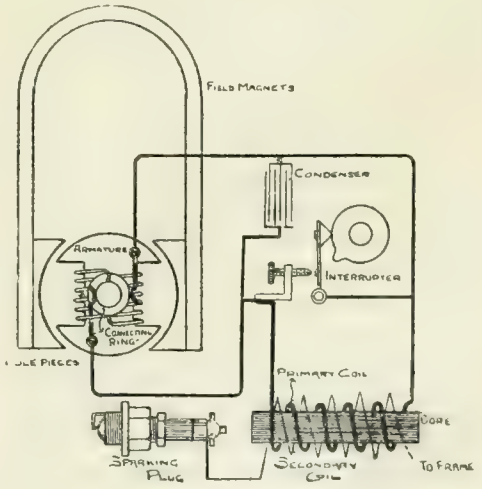


FIG. 4.—DIAGRAM OF EISEMANN HIGH-TENSION MAGNETO.

RECENT DEVELOPMENTS IN ELECTRIC LIGHTING.

A paper on this subject was read before the Junior Institution of Engineers on Friday last by Mr. H. T. Davidge, Professor of Engineering at the Ordnance College, Woolwich.

The following is an abstract of the paper :—

In considering a central electrical station designed for lighting purposes only, as many are, or in any station, that part of the plant devoted to lighting, it cannot be too clearly borne in mind that the lamp is the apex of a pyramid of which the base consists of the huge boiler plant, machinery and distributing gear there to be found.

For the purposes of investigating recent developments the author divides lamps into the following classes: A—Incandescent carbon lamps (1) arc lamps, (2) filament lamps of pure carbon, (3) filament lamps of compounds of carbon; B—Non-carbon lamps (1) arc lamps, (2) filament lamps, (3) electrotype lamps, (4) vapour lamps (5) cathodic bombardment lamps, (6) high frequency lamps without wires.

For many years the principal developments in arc lamps consisted in perfecting the mechanism to ensure regularity of feed, and the adaptation of the feeding mechanism to alternating current when this became necessary.

A typical continuous current arc lamp is shown by the Brockie-Pell. With regard to carbon filament lamps it may be said that the only advance made in connection with this class of lamp has been in the economical and rapid production of reliable filaments of uniform quality, and in the production of reliable filaments suitable for high pressures.

NON-CARBON LAMPS.

The only arc lamp in which the arc is maintained between pieces of material other than carbon, is the Steinwetz, in which the positive is of copper and the negative of an oxide of iron. It is undoubtedly of a very novel type, and further experiments will be watched with great interest. Of non-carbon filament lamps the Osmium may conceivably have a future before it, but any new lamp of this class to make headway must be either more efficient electrically or cheaper, or, preferably, both. A most determined effort in this direction is to be found in the new "Tantalum" lamp. Metallic tantalum, hitherto a practically unknown element in the pure state, has been made to form filaments, and these are of a very tough and reliable nature. The resistance of tantalum, like most metals, increases with temperature, the opposite of carbon; hence variations of the pressure do not tend to have such harmful effects upon this lamp as upon the carbon lamp. The results of tests appear to indicate that a 25-candle-power 110 volt lamp will have an efficiency of about 1·5 watts per candle when new, falling to 2·1 watts per candle-power after 1,000 hours. Among electrolytic lamps the Nernst is now well known, and it seems probable that with still further improvement the lamp has a great future before it.

Mercury vapour lamps also promise well. The Cooper-Hewitt has been described in PAGE'S WEEKLY, and the Bastian lamp is said to have been brought to a stage of being made suitable for alternating currents. The colour difficulty is also being combated by the makers of mercury vapour lamps by the introduction of substances, the spectrum of which would contain the red rays.

In conclusion, the author says that the final solution of the lamp problem has still to be made. If the engineer could but discover the secret of the firefly which gives out luminous radiation without heat waves the light of the future might be found. In that case it might be chemical and not electrical illumination.

A hopeful outlook for electrical engineers is in the direction of high-frequency alternations.

BIRMINGHAM ASSOCIATION OF MECHANICAL ENGINEERS.

The fourteenth annual dinner was held on Saturday at the Grand Hotel, Birmingham. Sir William White presided, while Mr. T. H. Dacres (vice-president) occupied the vice-chair. There was a large attendance, including Mr. R. Holliday (president), the Right Hon. Jesse Collings, M.P., Mr. E. Parkes, M.P., Professors Turner and Redmayne, Dr. Sumpner, Colonel E. J. Hart, Colonel Kimberley, Alderman Johnson, Messrs. E. B. Edmonds, Hugo Gibson, C. Y. Hopkins, W. H. Thornbery, J. Bettany, R. B. Hodgson, H. J. Grant, W. Deakin, Louis O'Brien (secretary), W. Playdon (assistant secretary), A. Cooke (treasurer), E. A. Lees, H. Toy, H. Austin, J. Pugh, C. A. Smith, J. S. Morris (London), J. H. Whitehead (Leeds), D. Cookson (Newcastle), Smith (Middlesbrough), Finlay Ross (Glasgow), T. Taylor (Woolwich), Marshall Halstead (U.S.A. Consul), and J. Cox. Letters of apology for non-attendance were read from the Right Hon. Austen Chamberlain, M.P., the Right Hon. Joseph Chamberlain, M.P., Lord Morpeth, Sir Benjamin Stone, Sir Alfred Hickman, and Sir J. Kitson.

Mr. E. Parkes, M.P., in proposing the City of Birmingham, said he believed the new University was destined to exert a large influence as a scientific University not only in Birmingham, but also in the country at large. He believed it would be one of the most remarkable examples of what they might term a modern University. They seemed to be entering upon a new phase of commercial and industrial life. One of the best things that could happen to Birmingham, would be greatly improved and cheaper facilities by means of which they could get their goods to the coast.

THE IMPORTANCE OF THE MECHANICAL ENGINEER.

Sir William White proposed the toast of "The Association." Birmingham, he said, was the great centre of mechanical engineering. Birmingham had coal at her doors, iron not far away, and every facility for modern manufacture. Birmingham, too, was the birthplace of the Institution of Mechanical Engineers. Mechanical engineering lay at the root of all engineering, and it was essential that whatever branch they went in for, they should have a training in mechanical engineering. As an example of what Birmingham had achieved he might refer to the Welsh water scheme as a triumph of engineering skill. It was a great work, and Mr. Mansergh's boldness of design and courage in execution of works of immense expense should never be forgotten. Here again, one saw that without the mechanical engineer the other departments of engineering could never have accomplished the work involved in the Welsh water scheme.

He hoped the Association would draw nearer to the University, and help it with advice and assistance when required. Theory and practice must not be divorced. They must not teach without work, and he was glad that in their connection with the technical school there was this recognition of scientific training.

INSTITUTION OF CIVIL ENGINEERS.

A meeting of the Association of Yorkshire Students of the above Institution was held in the Law Institute, Leeds, on February 2nd, the President (Mr. Ewing Matheson, M.Inst.C.E.) in the chair, when a paper was read by Mr. K. Lightfoot, Stud.Inst.C.E., on "Modern Refrigerating Machinery."

Mr. Lightfoot explained the action of a refrigerating machine and worked out expressions for the efficiency and the co-efficient of performance. He then gave descriptions of the various systems now used commercially, namely, the absorption, dry air, and compression machines, and discussed the question of the employment of ammonia, carbonic acid, or sulphurous acid for the working substance in the latter type of machine, which is by far the most efficient. Various parts of a modern compressor were described in detail, and the application of the compression system to the production of ice and the cooling of stores was shown.

A discussion followed.

FUEL ECONOMY IN STEAM POWER PLANTS.

The discussion on Messrs. Booth and Kershaw's paper was concluded at the last meeting of the Institution of Electrical Engineers.

Mr. Halpin said that radiation in pipes was a thing over which great care must be taken. With regard to mechanical stoking, he believed that the chain grate left a good deal to be desired owing to the large quantity of air let in.

Mr. Rosenthal, speaking from experience, said that central station engineers were well acquainted with the subject dealt with. The question of thermal storage was not the mystery the authors of the paper seemed to suggest, and the results referred to as being achieved at the Kensington station were only what he should have expected thermal storage to achieve Then, again, it was suggested that to analyse coal, the flue gases, and feed water, some special training was necessary. That was not so, for they were, after all, very simple matters, and any central station engineer could easily acquaint himself with all that was necessary to know in that connection. He did not agree with the reference to barbarously designed boilers; the results given by modern boilers disproved such a charge. It was said, too, that mechanical stokers were not a cure for the smoke evil; he could say most positively, that they were the only cure for smoke with smoke fuels, and that no amount of furnace design would prevent smoke unless the boiler was practically doing no work. He made that statement on the strength of twenty-five years' experience. Excess of air was a trouble in furnace management always, but, perhaps the authors of the paper were not aware that there were devices which enabled boiler plant to be run with 10 to 12 per cent. of CO_2. With regard to superheating the gain was on the coal bill, and central station engineers, of whom there were many present, would bear him out that they were quite alive to the importance of that question. One of the latest installations was at Hampstead, where a separately-fixed superheater had been put in. The advantages in regard to fuel economy were not so great as with a superheater which was an integra part of the boiler, but even under these conditions

the saving of fuel per unit generated was 10 per cent. Mr. Molesworth said that the authors made no reference to pulverized coal, but it was possible to effect a great saving in fuel consumption by its use. A comparison he had instituted between two Babcock and Wilcox boilers was that the saving with pulverised coal was 29 per cent. That was the figure with equal evaporation, but with an equal amount of coal the increased evaporation was 48 per cent in favour of pulverised coal.

Other speakers referred to the difficulty of burning bituminous fuel without smoke in a large station at times of sudden demand, to the advantages of the use of glazed bricks in boilers (which had the secondary purpose of minimising air leakage); to the bad fixing of ironwork, and to the disadvantages arising from expansion in boilers.

Mr. Booth, in his reply, denied that he was opposed to water-tube boilers.

The discussion was, however, curtailed by the time limit, and some notable contributions handed in will only be available in the official report.

MR. MARCONI'S FORTHCOMING MARRIAGE.

More than one story has been current recently as to the forthcoming marriage of Mr. Marconi. The industrious paragraphists have pledged the affections of Mr. Marconi in a wholesale kind of way, and have not hesitated to give their stories a touch of veracity by the addition of names and details. It is well therefore to state that an engagement has been authoritatively announced between Mr. Marconi and the Hon. Beatrice O'Brien, sister to Lord Inchiquin, and one of the pretty daughters of Ellen Lady Inchiquin. Mr. Marconi is Irish by right of his mother, and his future wife is a young and charming Irishwoman. The O'Briens are one of the most ancient families in Ireland. They claim descent from the great warrior who fell at the battle of Clontarf in 1014; and also from a Murrough O'Brien, brother of a king of Thomond. The barony dates from 1543.

Guglielmo Marconi was born in Bologna, April 25th, 1875. He was educated in Leghorn, under Professor Rosa, and, subsequently, at the University of Bologna, in which city were carried out the first experiments in connection with his system of wireless telegraphy. Marconi's invention was successfully tested in England between Penarth and Weston, and later by the Italian Ministry of Marine at Spezia. Wireless telegraphic communications were established between France and England in 1899; two years later he was enabled to transmit signals across the Atlantic Ocean from Poldhu, Cornwall, to St. John's, Newfoundland. In 1902, Mr. Marconi's system was installed on board the Italian cruiser *Carlo Alberto*, and during her voyage from England to Russia, he received messages from Cornwall and transmitted them to the Tsar and the King of Italy at Kronstadt. Later on, in December of the same year, he was able to announce the establishment of his system of wireless telegraphy between Canada and England. This was followed, a few weeks later, by the transmission of a message from the President of the United States to the King of England, inaugurating wireless connection between Cape Cod (Mass.) and Cornwall.

EAST BOSTON TUNNEL.

The East Boston tunnel, completed by the Boston Transit Commission, runs beneath a wide arm of Boston Harbour and is about 7,480 ft. in length. It is the only double track tunnel thus far built in America. The engineer taking advantage of the firm nature of the boulder clay, built the tunnel with a semi-circular roof, perpendicular side walls, and a flat invert. The irregular section that this method necessitated made it impossible to use a shield in the ordinary way. Consequently a semi-circular half shield was used for the construction of the upper half of the tunnel, and the lower half was built by means of drifting.

Two bulkheads were constructed, one at each end of the central portion of the tunnel extending below the river, and these were provided with the usual air locks. The next step was to drift out two small tunnels, one in the line of each side wall, and large enough to permit these walls to be built therein. The walls were built of concrete, and carried up to the springing of the semi-circular arch. On the top of the walls was laid a heavy trackway, upon which rested the ends of the semi-circular shield. The shield was then advanced by hydraulic pressure in the customary way, the clay being dug out, passed back through the central openings, and removed through the air locks. The concrete roof, 3 ft. in thickness, was then rammed into place, being temporarily supported on falsework, in the customary manner. The material lying between the side walls was then excavated down to grade and the concrete invert was built in place. Except for a blowout and one or two minor accidents, this very bold and original method of excavation was carried through successfully. For the above details as well as for the illustration on page 338 we are indebted to the Scientific American.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

East Ham.—Supply and delivery of five double-deck roof-covered tramcars complete with electrical equipment for the Borough Council. Mr. W. C. Ullmann, Nelson Street, East Ham ... ... Feb. 21

Newcastle-under-Lyme—Manufacture delivery and erection of three sets of gas engines and centrifugal pumps for sewage disposal works. Messrs. Wilcox and Raikes, 63, Temple Street, Birmingham... Feb. 22

Fulham. — Supply of condensing plant, boilers, economisers and stokers. Mr. Arthur J. Fuller, Borough Electrical and Consulting Engineer, Town Hall, Fulham Feb. 22

Uganda.—The Crown Agents for the Colonies invite tenders from manufacturers for the supply of galvanised wrought-iron piping and fittings to the Uganda Railway. Specification and form of tender for which can be obtained on application to the Crown Agents... ... Feb. 22

Islington. — Supply of electrical and engineer's stores for one year from April 1 next. Mr. W. F. Dewey, Town Clerk ... Feb. 23

Chelmsford.—Pumping machinery including horizontal gas-engine and a vertical treble ram-pump to raise 10,000 gallons of water per hour. Mr. Jos. Dewhurst, Engineer, Avenue Chambers, Chelmsford. Feb. 24

Sunderland.—Supply of four 250-kw. synchronous three-phase motor-generators, for the Corporation. Mr. J. F. C. Snell, Town Hall, Sunderland ... ... Feb. 24

Copenhagen.—Supply and erection of a gasometer of a capacity of 200,000 cubic feet per hour for the Lighting Department of the Corporation. Valby Gasworks, Valby, Copenhagen ... ... Feb. 27

Barcelona.—The "Gaceta de Madrid" of January 18th contains a notice calling for tenders for the supply and installation in the sheds of the Barceloneta wharf of two transhipment cars for platform cranes. Conditions of contract and plans may be inspected at the offices of the Secretary of the Port Administration, Casa Lonja, Barcelona ... ... March 1

Wimbledon.—Supply of stores to the Electricity Department for one year from April 1. Electrical Engineer, Durnsford Road, Wimbledon ... ... March 4

Johannesburg.—Supply of 100 electric cars, two electric water-cars, five-ton crane, car traverser, and workshop tools for Municipal Council .. .. March 6

Stoke Newington.—Supply, delivery and erection of sub-station plant and mains. Four-section contract. Mr. W. F. Loveday, Borough Surveyor, Town Hall, Milton Road, Stoke Newington, S.E. ... ... March 8

Last Day

Newport (Mon.).—Construction of main outfall and branch sewers for the Western Valleys Sewerage Board. Particulars at offices of Mr. Baldwin-Latham, Parliament Mansions, Victoria Street, S.W.; Mr. Geo. Chatterton, 6, The Sanctuary, Westminster, S.W.; or Mr. T. S. Edwards, Clerk to the Board, Newport (Mon.) ... April 8

Park Royal—Supply, delivery, and erection of plant in connection with the electricity generating station at Park Royal and proposed sub-stations and distributing centres at various places, for the Great Western Railway Company. Messrs Kennedy and Jenkin, 17, Victoria Street, S.W. ... ... March 13

Belgium.—The "Bulletin Commercial" announces that the Belgian State Railways invite tenders for the installation of two sets of ventilating and heating apparatus in the central workshops at Mechlin. Particulars of M. Slaghmuylder, Engineer-in-chief, Station du Nord, Brussels ... March 6 March 13

South Shields.—Supply, delivery and erection of the following plant in connection with the electricity supply department:—One multitubular marine type boiler, two medium-speed open-type vertical engines for two 550 k.w. direct current traction generators, two 500 k.w. direct current generators and traction switchboard. Mr. J. H. Cawthra, Borough Electrical Engineer March 13

Shanghai.—The Shanghai Municipal Council invite tenders for the construction and operation of about 24 miles of electric tramways on the trolley system in the streets of the Settlement of Shanghai; alternative proposals are desired for the single-trolley and double-trolley lines. Council's agents, Messrs. John Pook and Co., 63, Leadenhall Street, London, E.C., and Messrs. Fearon Daniel and Co., 90, Wall Street, New York. ... ... March 31

COMING CONTRACTS.

Mexico.—The "Diario Oficial" of Mexico, of January 12th, publishes the text of a Decree, authorising the Intercontinental Railway Syndicate to establish a smelting works either in the town of Guanajuato or on a site in the State of Jalisco, between the Pacific coast and the towns of Dolores Hidalgo, Guanajuato and Leon. All the machinery may be imported free of duty.

Austria-Hungary.—The "Moniteur des Intérêts Materiels" (Brussels) states that the Austrian Lloyd Company will shortly invite tenders for the construction of two steamers for use on an express service.

Maidstone.—An inquiry has been held into the application of the Town Council for sanction to borrow £60,000 for extending the light railway service.

Uxbridge.—Tenders are to be advertised for in connection with waterworks improvements.

Brazil.—The Budget expenditure of Brazil for 1905 makes provision, *inter alia*, for the disbursement of certain sums on submarine construction; plants and seeds for agriculturists; cattle for stock-breeding; railway construction; dredging works, waterworks and river improvement works.

Indo-China.—The French "Journal Officiel" of January 31st publishes a Decree authorising the construction of the following railways in Indo-China: (1) An extension of the Saigon railway to Khan-Hoa to cost 29,200,000 fr. (2) A line from Phan-rang to Danhim, being the first section of the Lang-Bian branch line to cost 11,500,000 fr. (3) A line from Hué to Kwangtri to cost 7,300,000 fr.

Stockton.—The existing destructor is to be extended at a cost of about £2,500.

Dumfries.—It is estimated that the total cost of the sewage purification works will amount to £39,000, and a further sum of £9,000 is to be borrowed.

Italy.—The Italian Government will on May 3rd offer a concession for the building of the Apulian aqueduct, the cost of which is estimated at £5,400,000. A deposit of £24,000 is required.

Sydney.—The Government has decided to advertise for tenders for the manufacture of iron from local ores to supply railway and other works.

CONTRACTS CLOSED.

Japan.—The Japanese Government has placed a contract with the North British Locomotive Combine, Glasgow, for 50 powerful locomotives. These are in addition to an order for a score of engines at present building for Japan. The contract is for prompt delivery. The Glasgow firm will ship the first order next month.

East Ham.—The tender of Meldrum Bros., Ltd. of Timperley, has been accepted for the erection of 6 of their Patent "Simplex" Regenerator Cells at East Ham Sewage Works.

Transvaal.—Ernest Newell and Co., Ltd., have secured a large order for tube mills for a gold-mining company in the Transvaal.

Consett.—The Consett Iron Company, Ltd., have placed orders for the construction, at Templetown, Consett, of fifty patent Otto-Hilgenstock coke ovens.

Mold.—The North Hendre Lead Mining Company, Ltd., Mold, have given a contract for a cross compound condensing horizontal-geared pumping engine to Andrew Barclay, Sons and Co., of Kilmarnock. The cylinders are to be 20 and 36-in. diameter by 34-in. stroke, and the steam pressure 70-lb. per square inch.

Middleton.—The Corporation have accepted the tender of Meldrum Bros., Temperley, Manchester, for a dust destructor; the tender of W. B. Haigh and Co., Ltd., Oldham, for the superheater; and that of Tetlow Bros., Hollinwood, Oldham, for boiler at the electricity station.

Battersea.—The Council have accepted the tender of C. A. Parsons and Co., at £4,680, to supply and fix one 750 k.w. turbo-generator set at the central electric generating station; the offer of Green and Sons, at £494 17s., to supply and erect at the central electric generating station a special fuel economiser, consisting of 236 tubes.

Sydney.—The City Council have accepted the tender of Henley's Telegraph Works Company for the making of house connections and the laying of electric light cables.

APPOINTMENTS VACANT.

	Last Day
Leeds.—The City Council have decided on the appointment of a waterworks engineer, at a salary of £1,000; Mr. Robert Fox, Town Clerk	Feb. 28
Ayr.—Tramways Manager under the Corporation. Salary £200 per annum. Mr. David Stewart, Council Chambers, Ayr	Feb. 18
Croydon.—Electrical Superintendent of Works. Salary £150 per annum. Mr. Alex. C. Cramb, Electricity Works, Factory Lane, Croydon . . .	Feb. 17
Birmingham.—Chemist to take charge of a new 20-ton per diem coal-testing plant, fitted with regenerative retort settings. Chairman of Works, Sub-Committee of Gas Department, Council House, Birmingham	Feb. 20
City Corporation.—Mr. D. J. Ross, engineer and surveyor to the City Corporation, is retiring on account of ill-health. It has been decided to advertise for a successor. The salary is fixed at £1,500, rising to £2,000. Candidates must not be over fifty years of age	—
London County Council.—Engineering assistant, at a salary of £500 per annum. Must be a member or associate member of the Institution of Civil Engineers, and have had experience. Particulars of Clerk to the Council, Spring Gardens, S.W.	Feb. 20
Newcastle.—Electrical Engineers to take charge of shift at Carville Power Station. Mr. J. S. Watson, Newcastle-upon-Tyne Electric Supply Company	—
London.—Assistant at the City and Guilds Central Technical College, to teach mechanical drawing and mechanism. Salary £150 per annum. Prof. Dalby, at College, Exhibition Road, S.W.	—

APPOINTMENTS FILLED.

Paisley.—Mr. Frederick Coutts, general manager of the Ayr Corporation tramways, has been appointed manager of the Paisley tramways at a commencing salary of £400 per annum.

Johannesburg.—Mr. G. H. Stanley, A.R.S.M., the Demonstrator in Metallurgy and Surveying in the Armstrong College, Newcastle, has recently received a very important appointment in South Africa, having been elected to the Professorship of Metallurgy in the Technical Institute, Johannesburg.

South Kensington.—The President of the Board of Education has appointed Prof. Henry Adams, M.I.C.E., late of the City of London College, to be a member of the Board of Examiners at South Kensington in the engineering section.

Bradford.—The Bradford Electricity Committee have appointed as assistant electrical engineer Mr. Charles William Salt, of Croydon, at a salary of £250 a year.

Dover.—The Dover Town Council have accepted the resignation of the station superintendent, T. McGill, and have appointed C. H. Lydall at £150 per annum.

Wakefield.—Mr. Harry A. Nevill, first assistant electrical engineer, has been appointed city electrical engineer of Wakefield, at a salary of £300 a year.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—
Consols: March 1st. General Settlements: February 24th, March 15th, 30th. Bank Rate, April 21st, 1904, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅛— 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4½ 5
3,210,000	1	2 6	Armstrong (Sir W G.), Whitworth and Co., Ltd.	1	3⅛ - 3⅜
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜— 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	103 —105
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord.	1	4 — 4¼
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1½— 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5¼
250,000	1	6¾d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 —103
150,000	4½	2/8½	Barrow Hæmatite Steel Co., Ld., O.	4½	1⅝ - 1¾
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4⅛ — 4¼
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	-	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	101 —103
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¼ - 12¼
£366,500	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	⅝— ¾
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	⅝— ¾
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	94 — 97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 — 1⅛
1,860,900	1	3¾d.	Do. Nos. 1,639,101-3,500,000	12/-	1⅛— 1⅜
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1½— 1⅝
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅜ - 1⅝
74,000	10	5%	Do. 5% Cum. Pref.	10	11¼ 11½
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord.	5	8¾ - 9
232,500	5	2/6	Do. 5% Cum. Pref.	5	5¼— 5½
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	¾— 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5⅜— 5⅝
£250,000	Stk	4%	Do 4% 1st Mort Db. Stk. Red	100	100 —102
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	31½ 32¾
57,031	10	10/-	Crossley, Bros, Ld, Ord. 40340/97370	10	16¼ 16¾
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾ 11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2¼ - 2½
1,259,594	1	3½d.	Dorman, Long & Co., Ltd.	1	⅞— ¾
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3¼— 3⅜
250,000	1	9¾d.	Dunlop (James) & Co., Ltd., Ord.	1	⅝— ¾
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ - 1¼
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9 10
69,754	13	12/-	Do. do. do.	10	7¾— 8
20,250	10	8/-	Elliott's Metal, Ltd.	8	5 - 5¼
5,000	10	5%	Do. Cum. Pref. 5%	10	8½ 9¼
186,748	Stk	4%	Do. Deb. 4%	100	94½ 96¾
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	10½— 11
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	97 —100
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000.	10	12½ 13¼
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½ -10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	4⅜ 4⅝
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5⅛ 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do 4% 1st Mort. Deb. Red.	100	90½—91½
16,800	10	-	Greenwood & Batley, Ltd., Ord.	10	4 4½
9,600	10	7%	Do. 7% Cum. Pref.	10	10½ 10¾
965,000	1	10%	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2¾ - 2⅞
344,000	5	2/6	Do. 5% Cum. Pref.	5	5⅞ - 6⅛
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 —107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 — 3
250,000	1	1/-	Hadfield's Steel Fdry Co., Ltd., Ord.	1	3⅝ - 3¾
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ - 11¼
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	1⅝— 1⅞
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	11 11½
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	4¼— 5¼
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	⅝— ¾
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅜ - 4¾
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5¾— 6

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord.	1	1¼—1⅜
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	12¾ 12⅞
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
37,500	10	20	Kynoch, Ltd.	10	19 — 20
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅜ 11
300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	⅝— ¾
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4¼
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref.	3	3¼— 4¼
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1⅝— 1⅞
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 — 11½
210,000	1	6d.	Measures Bros., Ltd., Ord.	1	1¼ - 1⅜
75,000	1	6¾d.	Do. 5½% Cum. Pref.	1	1⅜ - 1⅝
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	94 — 97
21,943	5	2/6	Muntz Metal, Ltd.	5	5⅜ - 5⅝
14,248	5	5%	Do. Pref. 5%	5	5⅛— 5⅜
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	74 — 76
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	11⅞ 12⅛
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3¼ 4
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	5¼ 6½
70,000	10	6/-	Pease & Partners, Ltd., Ord.	10	9¾ 9⅞
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 —100
20,000	5	3/-	Peebles (Bruce) & Co., Ltd., 6% Cm. P.	5	4¾ 5
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	3/6 4/
13,000	5	—	Do. 5½% Cum. Pref.	5	2¾ 3¼
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	⅛ ¼
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅞— 2
73,062	5	2/-	Do. New	5	1¾ 1⅞
£330,000	—	5%	Do. 5% Mort. Deb., Red.	100	99 —102
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf.	1	⅝ ¾
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	94 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	9¼ 9½
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	¾— 1
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1— 1⅛
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red.	100	91 — 94
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	⅝ ¾
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ ⅜
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	89 92
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560.	9	5⅛ 5⅜
£125,240	Stk	5%	Do. 5% Trust Mort. Deb.	100	105½—107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2¾ 2⅞
25,000	10	5/6	Do. 5½% Cum. Pref.	10	5 5¼
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	79— 82
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	16¾— 17⅛
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¼ 14½
634,732	1	4.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾ 1
538,845	1	6d.	Do. 5% Cum. Pref.	1	¾ 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ ⅝
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	67 - 71
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	1⅝ - 1⅞
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¾ 10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	32½ 32⅝
$360314100	$100	$1½	Do. 7% Cum. Pref. Stock	$100	97½ 97⅝
$162268000	$1000	5%	Do. 10 60) 1.5" Skg. Fd. G. Bds.	$1000	96 98
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord.	1	2¼ 2⅜
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1¾ 1⅞
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	114 —117
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	105 —107
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	105 —107
225,000	1	1/22½	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	⅛ ¼
500,000	1	7½d.	Do. 6% Cum. Pref. Ord.	1	⅛ ¼
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 — 89
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4¼ 4⅝
300	Stk	4½%	Do. Mort. Deb. 4½%	100	91 — 97
66,666	5	8/-	Willans & Robinson, Ord.	5	1⅜ 2⅛
66,666	5	3/-	Do. 6% Cum. Pref.	5	3 4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	77 82
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 86

Stocks and Shares marked | are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅜ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	⅝ — ¾
120,000	1	9½d.	Bell's Asbestos Co., Ltd.	1	⅛ — ¼
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¼ — 6¼
100,000	5	3%	Do. 6% Cum. Pref.	5	5¼ — 5⅝
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	101 —103
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref...	5	2⅜ — 2½
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	87 — 89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	⅛ — ¼
150,000	2	2/1	Do. 6% Pref.	2	1⅜ — 1⅝
£125,000	Stk	4½%	Do. 4½% Perp 1st Deb. Stk...	100	93 — 96
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	76 — 79
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	9½ — 10
40,000	5	2/6	Do. 5% Cum. Pref. ..	5	5¼ — 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	105 —107
85,000	3	1/6	Crompton & Co., Ltd...	3	2¼ — 2⅜
£100,000		5%	Do. 5% 1st Mort. Reg Debs.	100	98 — 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. .	5	7¾ — 8¼
61,000	5	3/-	Do. 6% Cum. Pref. .. .	5	5⅞ — 6⅛
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
£33,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1½ — 1⅝
£250,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	105 —108
99,261	5	1.6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261 .. .	3	⅝ — ¾
17,139	5	2/6	Do. "A" Shares Nos. 01 017 139	5	1 — 1⅛
£344,023	Stk	4%	Do. 4% Deb. Stock Red. .	100	77 — 82
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1⅛ — 1⅜
31,390	2	2/9	Do. 7% Cumulative Pref. ..	2	2¼ — 2⅜
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd.	10	13 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11 — 11½
35,000	5	2/3	Do. 4½% Cum. Pref. ..	5	5¼ — 5⅜
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	111 —113
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15 — 16
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 —102
7,500	10	—	Parker, Thos., Ltd.	10	6¾ 7
100,000	1	3d.	Scott (Ernest) & Mountain, Ld., Ord.	1	16/—16/6
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	34 — 36
£150,000	100	4%	Do. 4% Deb. Bonds	100	101½-103½

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
120,500	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅝ — 9⅛
250,007	5	2/6	Do. 5% Cum Pf.	5	5⅛ — 5⅜
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	11½ — 12¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 — 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 —102
£191,325	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 100
75,000	1	—	Bath Elec. Trams. Ld., Pf. Or. .	1	1/16 — 1/16
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	1/16 — 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1½ — 1⅝
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3½ — 4¼
£125,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	102 —105
			Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼ — 9⅝
156,437	10	6/-	Do. 6% Cum. Pref.	10	11 —11⅛*
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	120 —122
£250,000	Stk	4%	Do. 4% 2nd Deb. Stk. Red. .	100	97 — 99
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3⅞ — 4
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5⅜ — 5⅝
27,000	5	3/-	Do. "B" do.	5	5¼ — 5⅜

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	94 — 97
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	99 —102
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8⅞ — 9⅛
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
180,000	1	6d.	Cape Electric Tramways, Ltd. .	1	1⅛ — 1⅜
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ — 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 —104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 — 14
			Do. 6% Pref.	10	15½— 16½
59,987	10	6/-	Do. 6% Pref.	10	15½— 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3⅞ — 4
£150,000	Stk	4%	Do. 4% Deb. Stock . .	100	90 — 93
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref. .. .	10	10⅛ 10⅝
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	104 —106
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101 —103
314,016	1		Metropolitan Elec. Trams, Ltd., Def.	1	⅛ — ¼
500,000	1	6d.	Do. 5% Cum. Pref. .	1	1 — 1
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 —106
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	¼ — 1½
110,923	8	2/9	North Metropolitan Tramways Co..	8	4⅛ — 4⅜
£150,000	100	3¾%	Do. 3¾% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	102 —105
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8¾ 9¼
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 —102

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12½ — 12⅝
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9¾— 10⅛
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11½ — 12·
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	104 —106
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5⅜
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10¼— 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10¼— 10⅝
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord .	5	9 — 9⅝
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8¼ - 8⅝
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅜ — 5⅝
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	102 —104
44,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6⅞ — 7¼
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 —110
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O.	10	12⅜ — 13
40,000	10	6/-	Do. 6% Cum. Pref. . .	10	13⅜— 14
£100,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	122 —126
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	102 —104
40,000	10	4/-	County of London Elec Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	108 111
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	6¼ — 6⅜
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6½
£300,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd 5% Deb. Stk. Red.	100	86 — 91
12,000	5	2/-	Folkestone Elec. Supply Co., Ld., O	5	5¼— 6
£50,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10	—	Havana Electricity Co., Ltd. .	10	9⅜—10⅛
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½— 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—102
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp. Ltd., 6% Cum. Pref.	1	⅛ — ¼
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	13 — 13½

Stocks and Shares marked * are quoted ex-dividend

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	—	London Elec. Supply Corp., Ld., Ord.	3	2⅜ — 2⅝
60,000	5	3/-	Do. 6% Pref.	5	5¼ — 6
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	96 — 98
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18¼ — 18¾
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk , Red.	100	96 — 98
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution Ld., 4½% 1st Mort. Deb.	100	96 — 99
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	102 —104
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6⅛ 6⅜
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¼—14½
20,000	5	3/6	Do. 7% Pref.	5	8¾— 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾— 3¼
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	82 — 86
65,000	5	3/-	South London Elec. Sup. Co., Ltd, O.	5	4¼— 4½
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8¾d.	Do. 7% Cum. Pref.	1	1⅜ — 1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5⅛
30,000	5	2/6	Do. 5% Cum Pref.	5	5⅛ — 5⅜
£200,000	Stk	—	Do. 4½% 1st Mort. Deb. Stk. Red	100	105 —107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	13 — 13⅛
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛— 6⅜

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	1 — 1⅛
£763,580	Stk	17/6	Anglo-American Tel. Co., Ltd., Ord.	100	58 — 60
£3,118,210	Stk	35/-	Do. 6% Preferred Ordinary	100	103 —105
£3,118,210	Stk	2/-	Do. Deferred Ordinary	100	13¾— 14
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅛— 6⅝
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 —190
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	95 — 97
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾— 9¼
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/- 5/-	Direct Spanish Telegraph Co., Ord. 10% Cum. Preference	5 5	3⅜— 3⅝ 8 — 8½
£30,000	50	4½%	Do. 4½% Debs..	50	100-102%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11 —11½
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99 —101
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Db.	100	100—102
£400,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101-103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13½— 14
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	104 —106
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	138 —141
£2,000,000	Stk	17/6	Do. 3% Pref.	100	88 — 90
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	106 —108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	29¾— 30¼
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	45½ - 47½
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	1⅜ - 1⅝
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	109 —110
£1,966 667	Stk	5%	Do. Deferred	100	108—110
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5¼ — 5½
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	97 — 99
£689,593	Stk	4%	Do. 4% do. do. ..	100	102 —104
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1⅛— 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ - 1⅜
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	98 —101
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7 — 7½
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6¾ - 7¼
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	105—107
15,609	10	4/-	W. African Telegraph Co., Ltd. .	10	7¼ - 7⅝
£30,008	2½	-	West Coast of America, Ltd. ..	2½	⅛ - ⅜
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99 — 101

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	1/16 - 1/8
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	7¼— 8¼
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	7¼— 7½
£80,000	100	5%	Do. 5% Deb.	100	102 —104
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13⅜— 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —10⅝
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	102 —104

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend.	Name	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5% Cum. Pref.	10	8⅜— 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 —101
£672,900	Stk	4½%	British & African Stm. Nav. (1900), Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	93 - 95
40, 000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 - 6⅛
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	74 — 77
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13⅜ 14⅛
40,060	20	8/-	Do. Nos. 60 001-100,000	10	6 — 6½
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1⅛ - 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¼— 4⅝
36,758	8	4/9⅜	Do. Non-Cum. 6% Pref.	8	7¼ - 7¾
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	97 — 99
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¾— 3¼
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3¼— 3¾
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum Pref. ..	10	4½— 5
£1,160,000	Stk	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	127 —130
£1,160,000	Stk	19%	Do. do. Deferred ..	100	220 —223
15,000	100	30/-	Royal Mail Steam Packet Co. Ord .	60	26 — 27
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5⅛
39,075	5	2/6	Do. "B" Ord... ..	5	4 — 4⅛
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼ - 8⅜
24,000	10	4/6	Do. 4½% Cum. Pref..	10	9¾ 10¼
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	99 —101

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend	Name	Paid up.	Closing Prices.
60 000	1	9⅜d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	⅞— 1⅛
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	138 —143
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	5/16 7/16
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	5/16 7/16
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. .	1	1⅛ 1⅜
135,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1⅛ 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

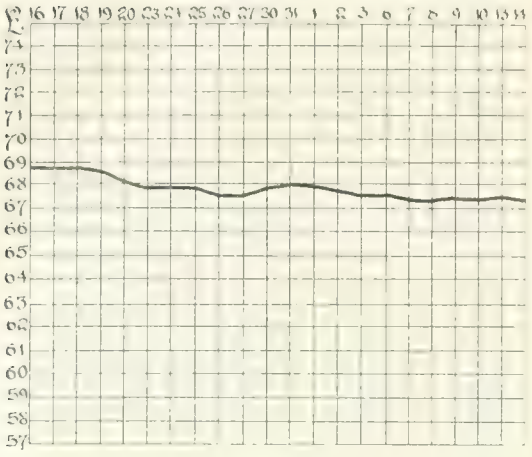
Present Amount Subscribed.	Shares	Last Dividend.	Name.	Paid up.	Closing Prices
10,000	10	7/6	Birm. Railway-Car, & Wagon, L., 1-10,000	10	21½ -
8,739	10	3/-	Do. Second Issue 1-8.739 .	4	8½ 9
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000. .	10	13 — 13½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50 000	7	9 9½
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 4½
14,567	10	1/3	Lancashire Wagon, Ord. ..	2	2¼ 2⅜
4,150	10	5%	Do. do.	10	10¼ 10½
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	42 42⅛
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6 —24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28 29
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 19½

Stocks and Shares marked * are quoted ex-dividend.

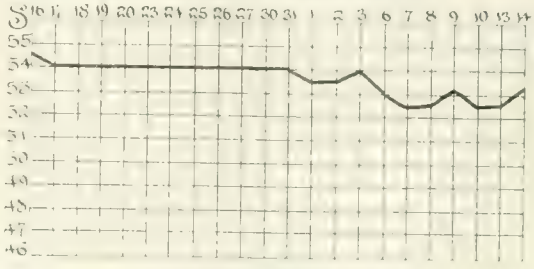
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JANUARY 16TH TO FEBRUARY 14TH, 1905.

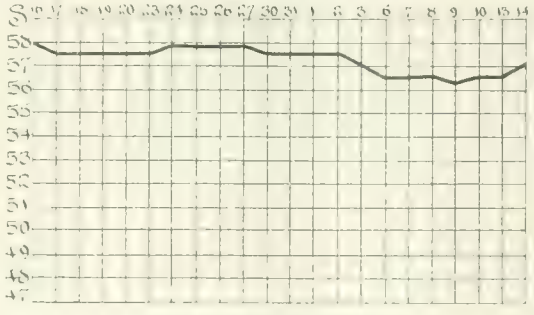
COPPER.



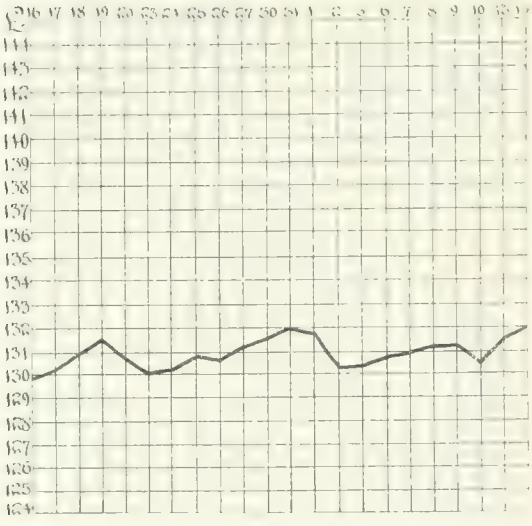
PIG IRON: SCOTCH,



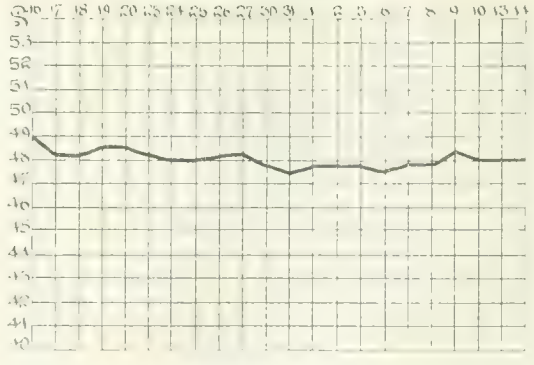
HEMATITE,



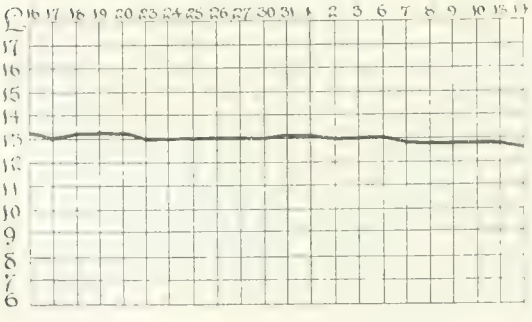
TIN.



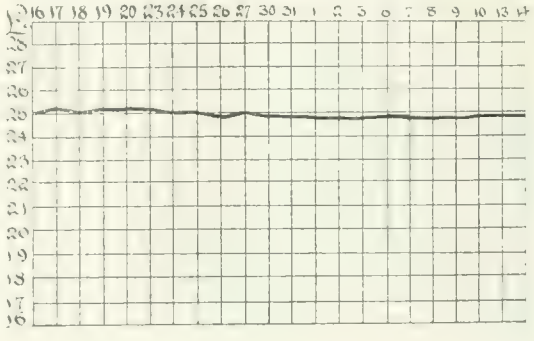
CLEVELAND.



ENGLISH LEAD.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, February 15th, 1905.

COPPER has been weak and realisations by tired bulls were the prelude to some rather heavy selling. When it became clear, however, that the bears had been at work, the fall was arrested and covering operations on the part of the ursine brigade brought about a recovery. The tone however is not strong, and advices from the States show a quiet market there, although expert opinion still favours higher prices for copper in the immediate future. It is estimated that important quantities of metal have to be taken up by manufacturers at near dates, and that large orders for early delivery have still to be placed. The closing price is £67 10s. cash and £67 17s. 6d. three months.

Only small business is reported in Tin and quotations have fluctuated within narrow limits. The Eastern markets have been closed on account of Chinese holidays, and, as Messrs. Merton and Co. point out in their last circular, none of the prominent operators cared to give a lead. There is less demand from America, but the situation here is fairly sound, and with stocks being drawn upon to some extent Eastern dealers are holding off for better prices.

Lead, with a coincidence of heavy arrivals and a poor demand has been dull and as low as £12 10s. has been accepted both for prompt and forward delivery. Some slight recovery from this low quotation is now to be noted.

The Spelter market has hardened under the influence of the Belgian coal strike which is calculated to restrict supplies. At the moment demand is poor, and this has served to check the sharp rise which might otherwise have taken place.

In the Iron and Steel section activity is to be recorded in the speculative markets, and quotations have fluctuated sharply, with higher prices on balance. Cleveland has been as low as 47s. 5d. and as high as 49s. 1d., but the higher level brought out selling orders.

The industrial situation remains good. Advices from the States are distinctly encouraging, and the figures of production and consumption for January may be fairly described as remarkable. The output has been large, but stocks have been again drawn upon. The reports of correspondents from our own trade centre are still cast in a hopeful strain.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

	£	s.	d.
Steel :			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,,	6	17	6
,, ,, ,, Ship Quality Plates	5	17	6
Siemens' Steel Bars, Boiler Quality	6	17	6
,, ,, ,, Ship ,,	6	7	6
,, ,, Angles	5	7	6
Manufactured Iron :			
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

	£	s.	d.	
Steel Angles (Glasgow Steel)	5	7	6	per ton.
Steel Ship Plates (Glasgow Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quotes :—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B H S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£ s. d.
Angles—Phœnix	6 5 0
,, Best	6 15 0
,, Extra Best	7 5 0
Gas Tube Hoops—Phœnix Best	6 15 0
Plates—Phœnix	—
,, Best Boiler	7 10 0
,, Best Best Boiler	8 0 0
,, Extra Best Boiler	9 0 0
Boiler Tube Strips—Phœnix Best Best	8 0 0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:

	No. 1. £ s. d.	No. 3. £ s. d.
Coltness, f.a.s. Glasgow	3 5 0	2 15 0
Gartsherrie ,,	2 19 0	2 13 6
Summerlee ,,	3 0 6	2 15 0
Carnbroe ,,	2 16 6	2 12 6
Langloan ,,	3 4 0	2 15 0
Calder ,,	2 19 0	2 13 6
Clyde ,,	2 18 6	2 13 6
Glengarnock, f.o.b. Ardrossan	2 19 0	2 12 6
Eglinton ,, ,,	2 14 6	2 12 6
Dalmellington, ,, Ayr	2 14 6	2 12 6
Shotts ,, Leith	2 19 0	2 14 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£ s. d.
W.W. Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W. Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron. £ s d.	Steel. £ s. d.
(BF) Bars	6 10 0	7 5 0
,, ,, Angles	7 0 0	7 5 0
,, ,, Tees	7 10 0	7 15 0
WIW Hoops	7 0 0	7 10 0
,, ,, Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:

	Singles 20 G 9fin. by 36in. per ton. £ s. d.	Doubles 21 G to 24 G 96in. by 86in. per ton. £ s. d.
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£ s. d.	£ s. d.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

Tinned Sheets:

	Singles 20 G to 108 by 36in. per ton. £ s. d.	Doubles 21 to 24 G to 96 by 36in. per ton. £ s. d.
Best Coke (Finish)	28 0 0	29 10 0
,, Charcoal (Finish)	30 0 0	31 10 0
Extra ,, ,,	32 0 0	33 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.
At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£ s. d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11 15 0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14 7 6	,,

Galvanized Working Up-Sheets:

	£ s. d.	
24 G., f.o.b. London, in Bundles	13 15 0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.	
Crown Bars	6 10 0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7 0 0	,,
Angles	6 15 0	,,
,, Best	7 5 0	,,
T's	7 0 0	,,
,, Best	7 10 0	,,
Best Shoe Iron	8 0 0	,,
,, Rivet Iron	8 0 0	,,
,, Best Rivet (Special)	9 5 0	,,
,, Cable	9 5 0	,,
,, Screwing	8 5 0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
,, ,, Best Best	9	5	0	,,
,, ,, Treble	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

Coke Tin-plates.	Per Box. f.o.b. Wales. £ s. d.
C 18¾ by 14 124s. 110 lb. "BV"	0 12 10½
C 20 by 10 225s. 155 ,, "Jumbo"	0 18 0
C 20 by 14 112s. 108 ,, "Lydbrook"	0 12 4
C 28 by 20 112s. 216 ,, "Lydbrook"	1 5 0

Charcoal Tinplates :

C 20 by 14 112s. 108 lb. "Allaway"	0 13 1½

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	12	0	per ton.
Billets	at 3	14	0	,,
Sheet Bars	at 3	16	0	,,

Finished Steel :

Bars	at 5	0	0	per ton.
Angles	at 5	1	0	,,
Tees	at 5	4	0	,,
Joists	at 4	10	0	,,
Fencing Standards	at 5	2	0	,,
Shoeing Bars	at 5	4	0	,,
Tyre Bars	at 5	4	0	,,
Half-Round Bars	at 5	5	0	,,
Heavy Rails	at 4	15	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	132	0	0	to	132	10	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	133	0	0	to	133	10	0	,,
Straits G.M.B., cash Warehouse, Net	131	17	6	to	132	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	130	5	0	to	130	10	0	,,
Australian, Mr. Bischoff, Warehouse, Net	132	10	0	to	132	15	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	67	7	6	to	67	10	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	67	15	0	to	67	17	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	70	0	0	to	70	10	0	,,
English, Best Select, Warehouse Net	70	10	0	to	71	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	80	0	0	to	80	10	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit.
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾				per lb.
Sheathing ,, ,,	0	0	6⅝				,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	15	0	to	25	0	0	per ton.
Blende of 50 % Net	6	16	6	to	7	0	0	,,
Calamine, Net	6	19	0	to	7	0	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	12	15	0	to	12	17	6	per ton.
Spanish, ex ship, Dis. 2½%	12	10	0	to	12	12	6	,,
Lead Ore of 70 %, Net	6	10	0	to	6	12	6	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	36	0	0	to	37	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	8	10	0	to	9	10	0	,,
Crude, ex ship, Dis. 2½ %	13	10	0	to	14	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	12	6	per flask.
Italian ,, ,, ,,	7	11	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1¼ to 3½)	9	6
Small Nuts (¾ to 1¼)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:		
Steam.	s.	d
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.		
High Hazel.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6
Steam.—Top Hard.		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	11	,,
	Tartaric ... at Manchester	0	0	10⅞	,,
Acetate of Lime:	Brown at Manchester net	9	10	0	per ton.
	Grey ,,	11	10	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
	Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	13	5	0	,,
Arsenic:	Best White Powdered net	12	5	0	,,
Bleaching Powder, 35%	,,	4	10	0	,,
Borax:	British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:

Benzole, 50 90 %	,,	0	0	8¼	per gal.
,, 90%	,,	0	0	10	,,
Carbolic Acid Crystals, 34 35° C.	,,	0	0	6⅞	per lb.
,, ,, ,, 39/40° C.	,,	0	0	7⅛	,,
,, ,, Liquid, 97 99 %	,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b.	,,	0	2	0	,,
Creosote, ordinary good liquid	,,	0	0	1¼	,,
Naphtha, Crude, 20 % at 120° C.	,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b	,,	0	0	8½	,,
,, ,, 95 % at 160° C. ,,	,,	0	0	9½	,,
,, ,, 90 % at 190° C. ,,	,,	0	0	10½	,,
,, Rectified, flash point over 73° F. f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100 F. f.o.b.	,,		1	0	,,
Naphthalene, all qualities.					
Pitch f.a.s. Manchester.	,,	1	12	0	per ton.
Copperas: Green, in bulk	,,	0	12	6	,,
,, barrels f.o.b. L'pool	,,	1	19	0	,,
Cake	,,	1	2	6	,,
Copper: Sulphate		22	15	0	,,
Cyanides: 98% minimum f.o.b. net		0	0	8	per lb.
Lead: Acetate (Sugar) White, English		27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K		24	5	0	,,
,, ,, Grey		21	15	0	,,
,, ,, Brown at Manchester		17	0	0	,,
Nitrate		24	0	0	,,
Litharge, Flake		15	10	0	,,
,, Powder		16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%		15	10	0	,,
White ,, ,, Dry ,, ,, ,,		16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.		0	2	10	per gal.
Solvent		0	2	7	,,
Potash: Bichromate... delivered England		0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull		18	0	0	per ton.
Caustic, 75/80 % ,, ,,		20	10	0	,,
Chlorate net		0	0	3 1/16	per lb.
Montreal in Store, Liverpool		35	0	0	per ton.
Prussiate, Yellow net		0	0	5	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... ,,	5	5	0	per ton.
	,, ,, ,, Refined ... ,,	6	5	0	,,
	,, Carbonated, 48 % ... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ... net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % ... net	6	10	0	,,
	Caustic, White, 77 % ... ,,	10	10	0	,,
	,, ,, 70 % ... ,,	9	12	6	,,
	,, ,, 60 % ... ,,	8	12	6	,,
	,, Cream, 60 % ... ,,	8	10	0	,,
	Crystals, in bags ...	3	0	0	,,
	,, barrels ...	3	7	6	,,
	Acetate ... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs ...	6	15	0	,,
	Bichromate ... delivered England ...	0	0	2¼	per lb.
	Chlorate ... net	0	0	3 1/16	per lb.
	Nitrate ... ex quay Liverpool, ... ,,	11	7	6	per ton.
	Phosphate ...	9	5	0	,,
	Prussiate ... net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts) ...	1	12	6	,,
	,, (Saltcake, 95%) ...	1	15	0	,,
Sulphur:	Recovered ...	4	15	0	,,
	Roll ...	6	15	0	,,
	Flowers ...	7	10	0	,,
Zinc:	Sulphate ...	6	15	0	,,

MINERALS.

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92% ...	3	10	0	per ton.
	Sulphate, No. 1, White ...	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/– to about 30/– per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports ...	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre:	French JC ... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF ...	5	10	0	,,
Talc:	(French Chalk) ... c.i.f. Liverpool	3	10	0	,,

OILS, etc.

		£	s.	d	
Aniline Oil	... net	0	0	4¾	per lb.
,, **Salt**	... ,,	0	0	4½	,,
Castor Oil:	French, 1st pressure, f.o.b. Marseilles less 1½% ...	22	5	0	per ton.
	English, 1st pressure, f.o.r. Hull, less 2½% ...	23	10	0	,,
Cocoa Nut Oil:	Ceylon, ex store Manchester ... net	29	10	0	,,
	Cochin, ex store Manchester ... net	32	0	0	,,
Cotton Seed Oil:	Refined at Hull, less 2½% naked ...	13	7	6	,,
	Edible ... at Hull, less 2½% naked ...	13	17	6	,,
Glycerine:	Crude, 80% ... net	31	0	0	,,
Linseed Oil:	Raw ... at Hull, less 2½% naked ...	13	2	6	,,
	Boiled ... at Hull less 2½% naked ...	14	2	6	,,
Starch:	American Pearl ... at Manchester, net	9	0	0	,,
	Dextrine ... ,, ,,	18	0	0	,,
	Farina ... ,, ,,	15	15	0	,,
Shellac:	Standard TN orange spot ...	140/-			per cwt.
Turpentine:	American ... at Liverpool	38	10	0	per ton.
	Russian ... at Hull ... net	19	0		,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine ...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine ...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine ...	,,	0	1	3		0	1	8
Quebec Red Pine ...	,,	0	1	6		0	2	0
Quebec Oak, 1st quality ...	,,	0	2	3		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash ...	,,	0	1	6		0	2	3
Elm ...	,,	0	3	3		0	3	10
Hickory ...	,,	0	2	0		0	2	6
Quebec Birch ...	,,	0	1	6		0	2	3
St. John Birch ...	,,	0	1	6		0	2	0
Birch Planks ...	,,	0	0	9		0	0	11
Spruce Spars ...	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine ...	per std.	22	10	0	to	32	10	0
2nd do. do. ...	,,	17	0	0		22	0	0
3rd do. do ...	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	15	0		7	5	0
Lower Ports Spruce ...	,,	6	10	0		6	15	0
Spruce Boards ...	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn ...	per cub. ft.	0	1	4	to	0	1	8
Sawn ...	,,	0	0	11		0	1	6
Planks, Stowage ...	,,	0	0	10		0	1	0
Boards, Prime ...	per std.	12	10	0		16	0	0
Oak Timber ...	per cub. ft.	0	1	6		0	2	6
Oak Planks ...	,,	0	1	6		0	2	1
East India Teak ...	per load	12	0	0		16	0	0
Greenheart ...	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood ...	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown ...	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling ...	,,	0	1	9		0	1	11
Stettin ...	,,	0	1	9		0	1	11
Swedish ...	,,	0	1	0		0	1	3
Riga Whitewood ...	,,	0	1	0		0	1	3
Norway Mining Timber ...	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak ...	,,	0	2	6		0	3	0
Norway Spars ...	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality ...	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality ...	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality ...	,,	10	10	0		12	10	0
St. Petersburg, 1st quality ...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Getle ...	,,	11	10	0		16	0	0
Wyburg ...	,,	11	0	0		12	10	0
Uleaborg ...	,,	10	0	0		12	10	0
Gothenburg ...	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

1904.

288743a. A. E. Stove, London. Feb. 1st.—Means for securing hose couplings to hydrants, fire cocks, and the like. (Date applied for, Dec. 29th, 1904.)

1905.

1761. S. H. Adams, Scotswood-on-Tyne. Jan. 30th.—Improvements in pen-stocks and sluices.

1770. J. Kirkman, Chorley, Lancs. Jan. 30th.—Improvements in the manufacture of packing for the stuffing boxes of steam engine piston rods, and for other similar joints requiring to be steam, air, or water tight.

1772. A. C. Lee, Slough. Jan. 30th.—An automatic fog signal (detonator) placing and displacing machines for railway use.

1780. J Gregory, Lincoln. Jan. 30th. Improved method of fog signalling on railways and other places or stations.

1788. O. Blankmeister, London. Jan. 30th.—Improvements in the production of reels of leaf metal.

1794. C. A. Hunton and G. R. Phipps, London. Jan 30th.—Improvements in shifting spanners, wrenches, and the like.

1805. J. C. Merryweather, London. Jan. 30th.—Automobile fire engine.

1806. A. Spies G. m.b.H., London. Jan. 30.—Improvements in apparatus for weighing railway vehicles (Date applied for, Mar. 12th, 1904.)

1807. Fried. Krupp Akt.-Ges., London. Jan. 30th.—Improvements in sighting attachments for ordnance. (Date applied for, Mar. 12th, 1904.)

1808. J. Carlu, London. Jan. 30th.—An improved appliance for cleaning and lubricating chains.

1814. J. Brundrit, London. Jan. 30th.—Improvements in elastic fluid turbines.

1824. F. W. Howorth, London. Jan. 30th.—Improvements in edge runners and moulding presses. (*Buhler Bros., Switzerland.*)

1825. G. Simpson, London. Jan. 30th.—Improvements in submarine vessels and mechanism connected therewith

1830. The Warwick Machinery Co., Ltd., and K. Ahlquist, London. Jan. 30th.—Improvements in bucket construction for steam turbines.

1834.—H. S. Walford, London. Jan. 30.—Improvements in and relating to the steering gear of boats, launches, and vessels (*C. E. Lawrie, South Africa.*)

1848. F. B. Hart, Stockport. Jan. 31.—Improvements in railway signalling.

1854. A. Smallwood, Birmingham. Jan. 31st.—Improvements in and relating to furnaces for annealing and the like purposes.

1855. A. Smallwood, Birmingham. Jan. 31st.—Improvements in the means for generating and applying heat in steam boilers of the Lancashire, Cornish, or other similar type.

1860. A. A. Blackburn and H. Wernon, Manchester. Jan. 31st.—Improvements in workshop trolleys.

1866. A. S. Nelson, London. Jan. 31st.—Maximum traction truck.

1872. J. T. Stewart, Oxford. Jan. 31st.—Steam superheaters.

1873. H. P. Young, Birmingham. Jan. 31st.—Improvements in the means of propelling steamships or the like.

1903. C. A. H. Bartelt, London. Jan 31st. Improvements in or relating to steam generators.

1907. L. Hachenburg, E. Sandford, and L. Sandford, London. Jan. 31st.—Improvements in turbine engines

1918. J. H. Petterson and C. H. Rawson, London. Jan. 31st.—Improvements in rotary engines.

1922. N. Johnson, London. Jan. 31st.—Improvements in apparatus for cutting or excavating trenches.

1925. The British Thomson-Houston Co., Ltd., London. Jan. 31st.—Improvements in valve mechanism. (*The General Electric Co., U.S.A.*).

1927. The British Thomson-Houston Co., Ltd., London. Jan. 31st.—Improvements in and relating to shaft bearings and supports therefor. (*The General Electric Co., U.S.A.*).

1941. D. D. Danziger, London. Jan. 31st.—Improved white metallic alloy.

1962. G. Jackman, Johnstone. Feb. 1st.—Improvements in and connected with bar working lathes.

1967. W. D. A. Bost, Glasgow. Feb. 1st.—Improvements in steam generators.

1978. A. E. Tucker and C. T. Crowden, Birmingham. Feb. 1st.—Improvements in motive power engines.

1983. J. Cowle, Peebles, N.B. Feb. 1st.—Improved combined air and internal combustion engine.

1986. A. Barraclough, Heckmondwike. Feb. 1st.—Improvements in cocks and valves for water supply.

1988. A. E. Tucker and C. T. Crowden, Birmingham. Feb. 1st.—Improvements in motive power engines.

1990. J. E. Slack, Heaton Chapel. Feb. 1st.—Sectional water-tube boiler.

2006. J. Stevens, London. Feb. 1st.—Improvements in or relating to hydraulic presses, more especially designed for pressing metalliferous ore briquettes.

2007. H. T. Jones and J. P. Ludeman, London. Feb. 1st.—An improved blower or continuous air pump.

2010. G. Miettinen, London. Feb. 1st.—Improvements in rotary engines or turbines.

2023. H. E. Brown, London. Feb. 1st.—Improvements relating to brake mechanism for railway and other vehicles.

2028. R. A. Carter, London. Feb. 1st.—Improvements in apparatus for bending metal rods or the like.

2041. Palmer's Shipbuilding and Iron Co., Ltd., and R. J. Webster, London. Feb. 1st.—Improvements in rivet-making machines.

2051. J. Leckiep, Glasgow. Feb. 2nd.—Improvements in and relating to machinery for the manufacture of copper, brass, and like, metal pipes and tubes.

2054. P. E. Dowson, Manchester. Feb. 2nd.—Improvements in packing for glands or stuffing boxes for piston rods and the like.

2055. J. E. Davies, Bristol. Feb. 2nd.—A stand for ratchet machines for rock and coal boring.

2058. E. C. Browning, Southampton. Feb. 2nd. Improvements in or relating to screw bolts and nuts.

2061. Babcock and Wilcox, Ltd., R. A. McLaren, H. W. Kolle, and A. E. Parker, London. Feb. 2nd.—Improvements in chain brake stokers

2087. W. H. Scotton, London. Feb. 2nd.—Improvements in or relating to internal combustion engines.

2103. F. C. Ihlee, London. Feb. 2nd.—Improvements in or relating to internal combustion engines.

2115. The British Thomson-Houston Co., Ltd., London. Feb. 2nd.—Improvements in valve mechanism. (*The General Electric Co., U.S.A.*).

2126. R. P. R. Embury, Birmingham. Feb. 3rd.—Improvements in and relating to spanners and wrenches for the turning of certain kinds of nuts, bolts, and such like.

2127. H. Campbell, Halifax. Feb. 3rd.—Improvements in internal combustion engines.

2128. J. Hargreaves, jun., Manchester. Feb. 3rd.—Improvements in steam traps.

2135. W. M. Roberts, Glasgow. Feb. 3rd.—Improvements in steam turbines.

2164. A. Fodor and N. de Szemere, London. Feb. 3rd.—Improvements in railway car couplings.

2165. J. H. Morgan and P. B. Massey, Leeds. Feb. 3rd.—An improvement in spanners.

2184. W. H. Slatter, London. Feb. 3rd.—An invention or appliance to prevent railway trains, engines, or other rolling stock from jumping or leaving lines while going round a curve or elsewhere.

2191. A. Waibl, London. Feb. 3rd.—Improvements in water-gauges for steam boilers and the like.

2195. W. J. Reid, E. F. Reid, M. F. Reid, and I. Reid, London. Feb. 3rd.—Improvements in devices for self-lubrication of sheaves, pulleys, and other wheels designed for rotation on shafts or axles and bearings for reception of rotary shafts and axles.

2208. J. H. Godman, St. Albans. Feb. 4.—Improvements in internal combustion engines.

2219. A. O. Hamilton, Dundee. Feb. 4.—Improved compound or composition for removing scale from boilers.

2225. J. M. Fleming, Glasgow. Feb. 4th.—Self-propelling traction wagons.

2227. W. L. Jackson, Glasgow. Feb. 4th.—Improvements in machines for tunnelling and (or) cutting earth, rocks, and such like.

2243. A. F. Evans, London. Feb. 4th.—Improvements in oil engines.

2257. I. A. Timmis, London. Feb. 4th.—Improvements in the construction of bogie cars that run on rails.

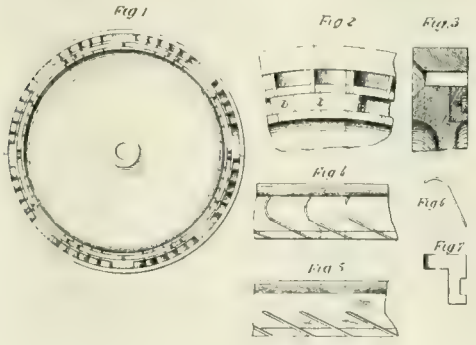
RECENT SPECIFICATIONS.

METAL AND ALLOYS.

Marquis Albert de Dion and Georges Bouton, of Seine, France. June 17th, 1904. (Date claimed under the International Convention.)—This invention relates to an improved process in the manufacture of nickel steel,. The process consists in the addition of silicon in the proportion of from 2 % to 5 % to pearlitic steel, and from 3 % to 5 % to martensitic steel. This process, while retaining the pearlitic and martensitic structures respectively, greatly increases the breaking load, and the elastic limit which the products will bear, while the contraction of area, elongation and resistance to impact are slightly increased.

ELASTIC FLUID TURBINES.

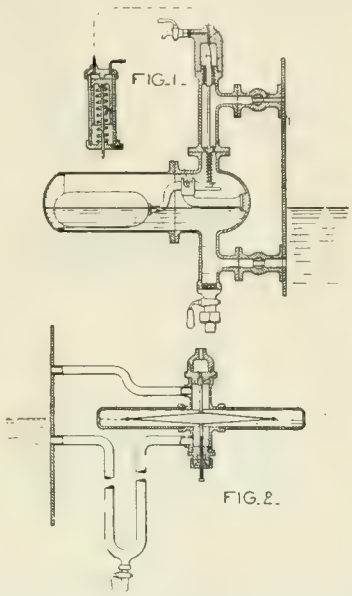
Howorth (Communication from Actiengesellschaft Der Maschinefabriken Von Escher Wyss and Co, of Zurich. Feb. 24th, 1904.—This invention relates to guide apparatus for steam and gas turbines, in which the blades are held in place by means of grooves and locking rings, In guide apparatus constructed in accordance with this invention the blades are formed with extensions which are inserted into grooves in the part carrying the blade wherein they are held by means of a locking ring that is let into the said part and engages in recesses formed in the extensions of the blades. The guide blades are formed with radially arranged extensions which are adapted to be inserted into grooves in a disc. The extensions are formed with recesses into which there engages a locking ring which is let into one face of the disc and is composed of a number of arc segments attached by means of screws to the wheel centre. This ring serves to keep the blade in position. In a modification the extensions



may be located on the opposite side of the blade, and in this case the slots will be situated in the ring in which the locking ring will be inserted. The drawings show a front elevation of the invention, and details thereof.

BOILERS.

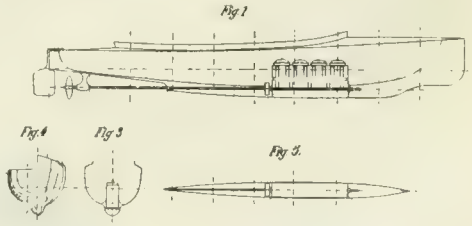
M. Deprez and J. Verney, of Paris. July 1st, 1904.—This invention, which is based on the scientific researches and experiments of Mr. Marcel Deprez, relates to an apparatus for maintaining a constant water level in boilers by the automatic control or operation of a water supply cock or of the steam supply to the pump, if a steam pump is used, said operation being effected by the rod of a piston on which the steam acts, said steam being admitted by a pin valve, operated by a float or other suitable means. The apparatus consists of a float arranged



within a casing communicating with the boiler and provided with a lever oscillating on a pivot or knife-edge, mounted on a support fixed to the casing, in combination with a pin-valve resting on the lever. A spring bears at one end on a fixed part of the apparatus, and the other end on the end of the pin-valve-rod, in such a manner as to force the pin-valve to follow the movements of said lever. The pin-valve is adapted to close a channel communicating with the steam space of the boiler, and a cylinder communicates with this channel, and is provided with a piston acted upon by a spring to move it to the end of the cylinder, the piston acting on the feed-water supply-cock.

SCREW-PROPELLED VESSELS.

J. A. Normand, F. E. Normand, and M. E. Normand, trading as Société Augustin Normand et Cie, of Le Havre, France. Jan. 10th, 1904. (Date claimed under the International Convention).—This invention relates to screw-propelled vessels, having a screw, or screws, fixed to a single shaft, and has for its object to obtain a better utilisation of the motive



power. The principal feature of this invention resides in forming a small hull under the principal hull, to which it is connected by continuous curves, the said small hull having a length and sharpness of such a form as to reduce to a minimum its resistance to propulsion. This smaller hull must be sufficiently wide and deep to allow of the rotary motion of the cranks and connecting-rod ends, and also when enclosed hydro-carbon motors are used, sufficiently wide and deep to receive the crank chamber of the motor. This arrangement differs from any of those previously tried, the small hull being made as short as compatible with the desired smallness of width or fineness of the lines of the vessel, and neither holding ballast nor containing the engines or boilers, its transverse dimensions being limited to what is necessary to permit of the propeller-shaft being in the position described, and to leave sufficient space for the rotation of the cranks and connecting-rods of a motor of the inverted cylinder type

NEW PUBLICATIONS.

"CENTRAL ELECTRICAL STATIONS:

Their Design, Organisation, and Management." By Charles Henry Wordingham, A.K.C. Second Edition. Charles Griffin and Co. Ltd. 24s. net.

Mr. Wordingham is fully cognisant with the fact that to attempt to deal exhaustively with central station work in one volume would be a task futile and impossible, for, as he remarks, no field of engineering practice involves more varied and numerous branches of science. The writer's aim in the present volume has been to give a comprehensive account of the problems which arise in the practical administration of central stations, whether of a scientific, an engineering, or a commercial nature; he discusses the general principles of design and operation, the training desirable for an engineer specialising in the branch of electrical engineering, and the field he may reasonably expect to be open to him. In the section devoted to central station work as a profession, the author gives some sound advice on the education of the young engineer; he strongly advocates theoretical training before practical, and objects to the students specialising too soon. The establishment of a central station, is amply discussed, the author then deals successively with systems of supply; the choice of a site for the generating station; architectural features of generating and transforming stations; choice of size and type of plant and general design of station; boilers, systems of draught and economy of waste heat; methods of firing boilers; coal handling, weighing and storing; the feeding of boilers; the transmission of steam; generators; condensing appliances; switching gear, instruments, and electrical connections; distributing mains—drawing-in systems, built-in systems, various dielectrics, insulation resistance and cost; distributing networks; service mains and feeders; testing of mains; recording the laying of mains; meters and appliances on consumers' premises; standardising and testing laboratory; secondary batteries; street lighting; the cost of production; methods of charging regulations of consumers' installations; general organisation of a central station; the generating station; the mains department; the installation department, the standardising department; the drawing office; the clerical department; the consumer; the routine of main laying. The work is profusely illustrated, including a number of folding ground plans and specimens of the various cards, forms and sheets designed for use in the clerical department, the organisation of which is carefully detailed.

SMITHSONIAN INSTITUTION REPORT.

Annual Report of the Board of Regents, showing the Operations, Expenditures, and Condition of the Institution for the year ending June 30th, 1903. Washington: The Government Printing Office, 1904.

The recently issued annual report of the Smithsonian Institution is a production upon which the authorities are to be heartily congratulated; the greatest care appears to have been expended upon the volume, and the illustrations and letterpress attain to a high standard of excellence. Following the secretary's collective statement of the year's transactions, among the more detailed accounts of investigations or discoveries by those who were directly responsible for the researches will be found much that is of permanent interest to the engineer, notably the articles on radium, aerial navigation, the electric furnace, high-speed electric interurban railways, and the Marienfelde Zossen high-speed electric railway trials, while Professor W. F. Durand contributes a scholarly appreciation of that eminent scientist and engineer, the late Robert Henry Thurston.

NEW CATALOGUES.

Messrs. Hartley and Sugden, Ltd., of Atlas Works, Halifax, have issued a new illustrated price list of the firm's low-pressure steam boilers; riveted high-pressure steam boilers and cylinder; steam heaters; independent hot water boilers; hot water boilers for brickwork setting; range boilers; steam jacketed pans and ovens; furnace pans and foundry ladles; hot water pipes and valves; cast-iron sectional boilers; radiators and fittings. Amongst the firm's specialities particular attention is called to the "Savile" boiler, specially designed for heating water for domestic supply in hotels, clubs and country houses; and to the cast-iron "White Rose" Sectional Boiler for low-pressure steam heating.

A neat little booklet printed in two colours on art paper, and devoted to an enumeration of the firm's specialities, has been issued by Messrs. Zeitz and Co., of 21, Lime Street, E.C., manufacturers of high-grade steel, files and tools.

Messrs. Kramos, Ltd., Bath. Price list No 3 describes and illustrates the Kramos Patent Electrical Resistance Pieces.

Messrs. Ferranti, Ltd., Hollinwood, Lancs. Catalogue No. 7 is devoted to current transformers for ammeters, power factor indicators, relays, and indicating wattmeters. Catalogue No. 13 is a price list of alternating current ammeters. Our attention is particularly drawn to the fact that the ammeter is of the induction pattern, the only moving part being a small aluminium disc. A special feature is its long open scale.

Messrs. Herbert Morris and Bastert, Ltd., Empress Works, Loughborough. Book 43 describes and illustrates h.m.b. spur gear pulley blocks, travelling pulley blocks, overhead runaways, hand overhead cranes, and electric overhead cranes. Attention is specially directed to the 1904 pattern of Class 44 electric crane, of which we note fuller particulars are given in book 47.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, FEB. 17.—Geological Society. Anniversary Meeting, 8 p.m. Chamber of Shipping. Meeting, Cannon Street Hotel 11 Dinner, Hotel Metropole, 7 p.m.—Royal Institution, 9 p.m.: Paper, "High-Power Microscopy," Mr. J. W. Gordon.—North-East Coast Institution of Engineers and Shipbuilders, Newcastle.—Institution of Mechanical Engineers, Storey's Gate, S.W. 8 p.m.: Annual General Meeting, Adjourned discussion on American Visit: Paper, "The Strength of Columns," Professor W. E. Lilley.

SATURDAY, FEB. 18.—Glasgow Technical Society, 7.30: "High Speed Tool Steels from the Users' Point of View," Mr. E. H. Robertson.—Staffordshire Iron and Steel Institute: "The Microstructure of Cast Iron," Mr. D. F. Hudson.—Institution of Electrical Engineers: Students Meeting, Paper, "Notes on the Construction of Large Telephone Equipments," by Mr. A. L. Stanton.

MONDAY, FEB. 20.—Society of Arts, 8 p.m.: "Internal Combustion Engines," Mr. Dugald Clerk.—Institute of Marine Engineers, Stratford, 8 p.m.

TUESDAY, FEB. 21.—Thomas Binney Institute, 8.30: Paper, "Modern Business: its Methods and Mistakes," Mr. G. C. Rickett, M.P.

WEDNESDAY, FEB. 22.—Society of Arts, 8 p.m.: Liverpool Engineering Society, Paper, "Sundry Practical Notes on Dock Construction," Mr. Fielden Sutcliffe.—Geological Society of London, 8 p.m.

THURSDAY, FEB. 23.—Institution of Electrical Engineers, Great George Street, S.W., 8 p.m.—Royal Institution, 5 p.m.: Paper, "Recent Work of the Geological Society," Mr. J. H. Teall.—Royal Society, 4.30 p.m.—Dundee Institute of Engineers: Paper, "Internally Fired Boilers," Mr. R. F. Sturrock.

FRIDAY, FEB. 24.—Manchester Motor Show Opens.—Edinburgh Motor Show Opens.—Royal Society, 9 p.m.: Paper, "Fungi," Professor H. Marshall Ward.—Physical Society.—Electro-Harmonic Smoker, Holborn Restaurant, Ladies' Night.

PAGE'S WEEKLY — Miscellaneous

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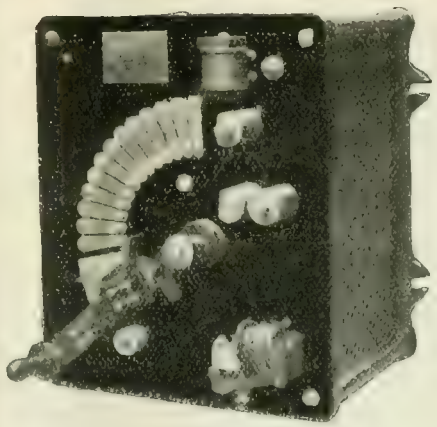

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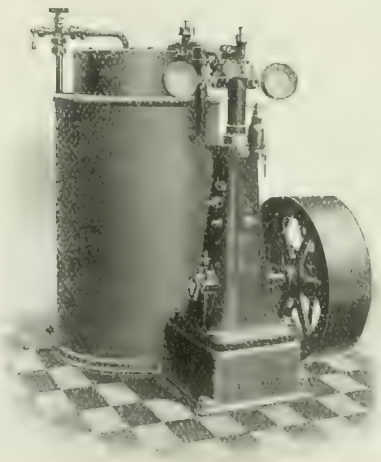

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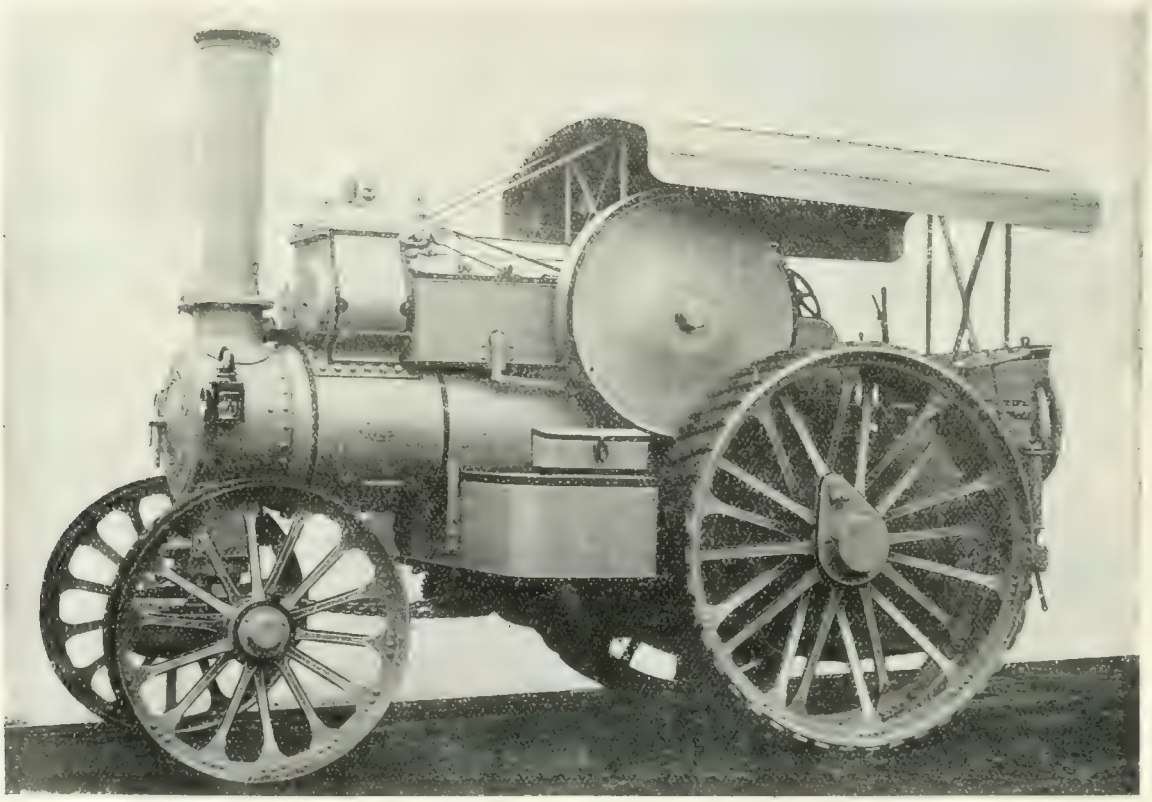

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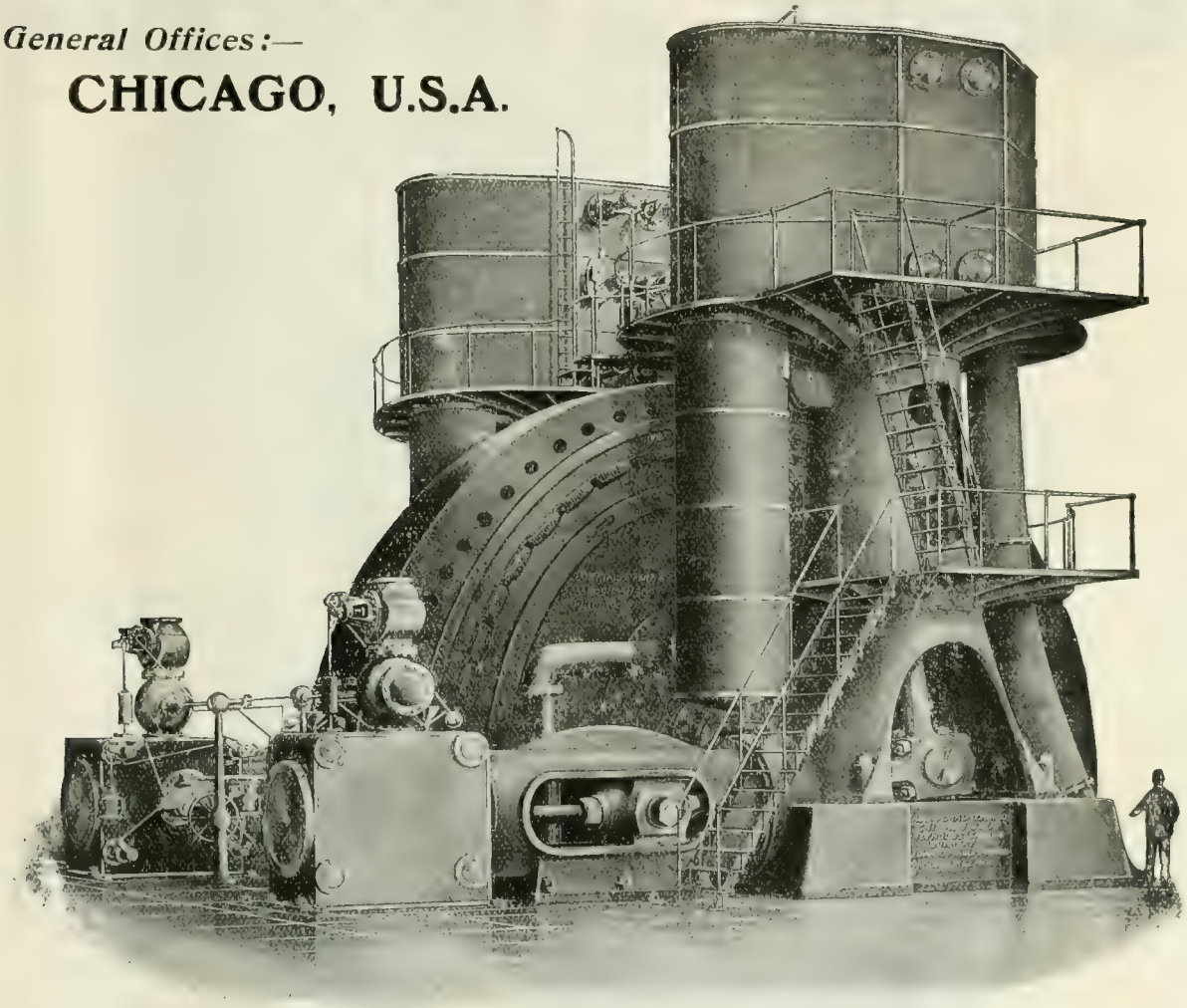

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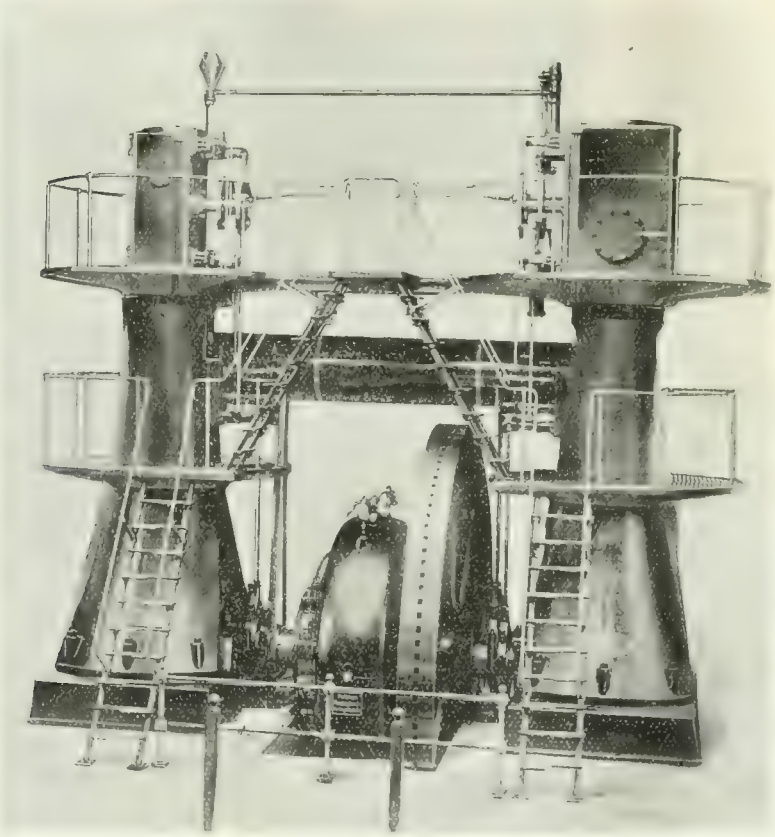

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Stroke of Cylinders	42 in.	Crosshead Pin, diameter and length	6½ in. by 6½ in.
Steam Inlet, diameter	6 in.	Crank Pin, diameter and length	7 in. by 7 in.
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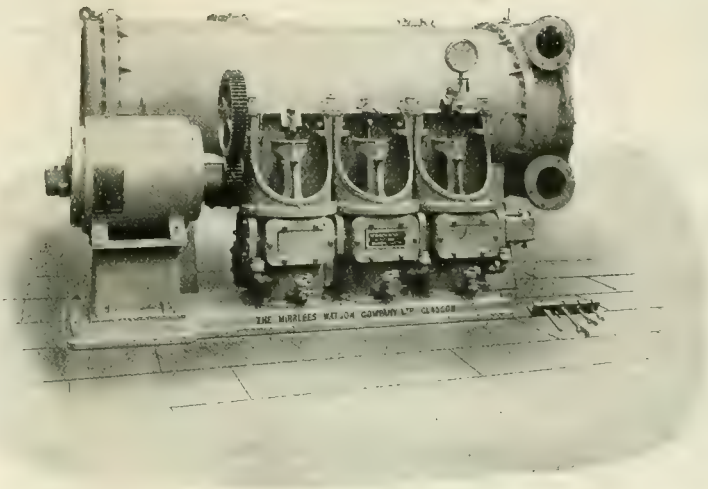

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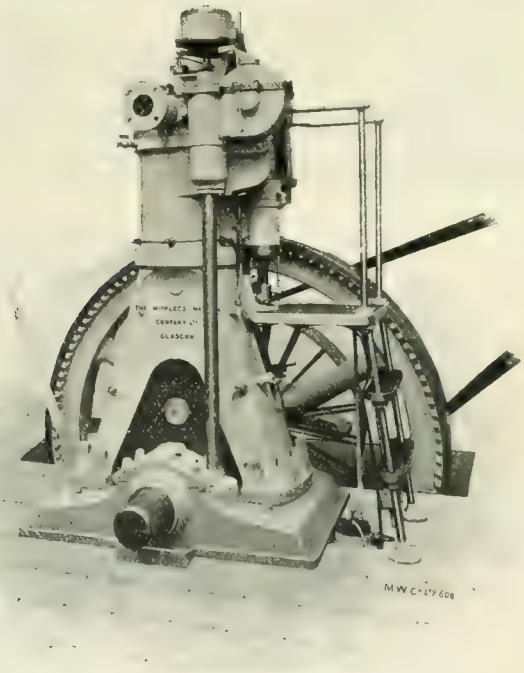

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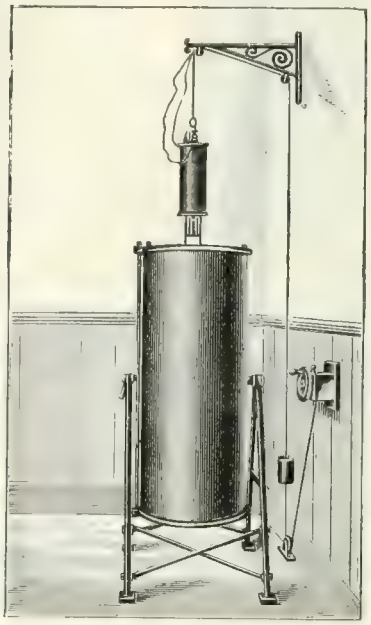

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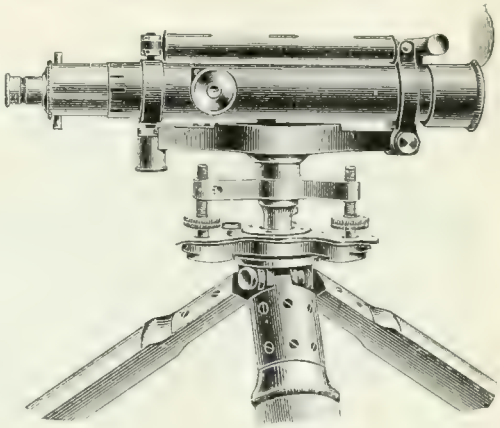

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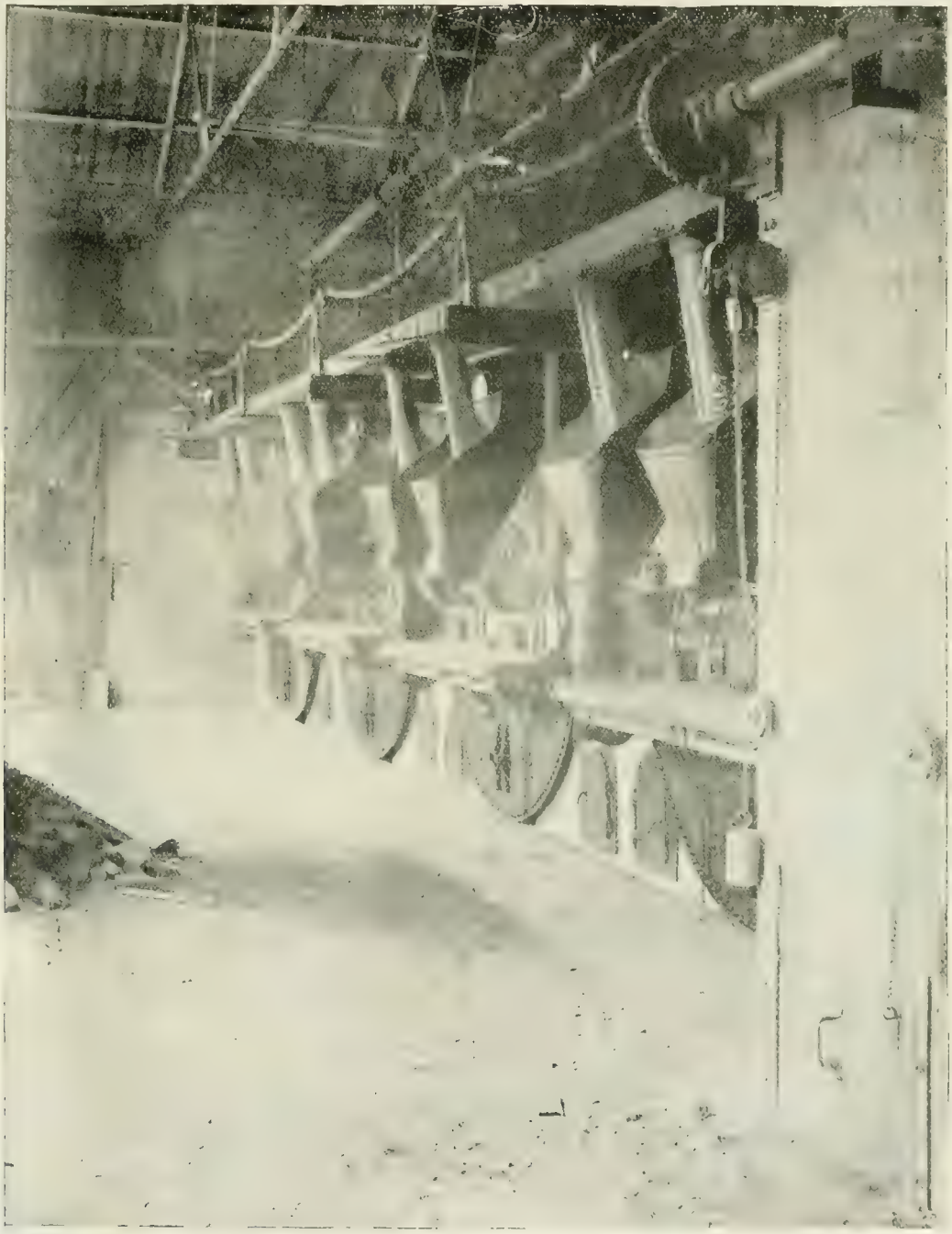

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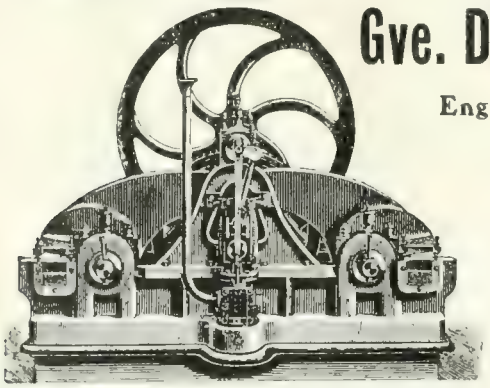

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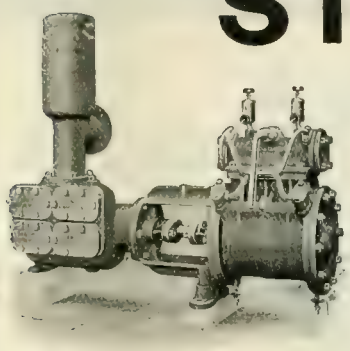

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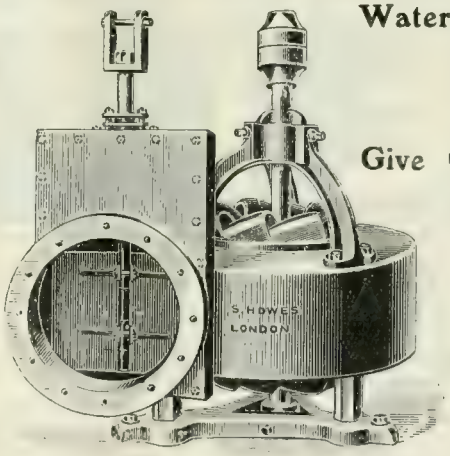

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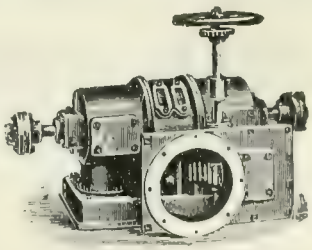

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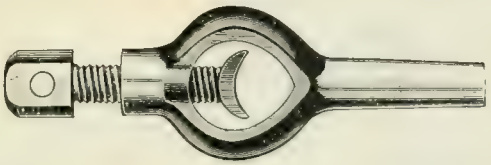

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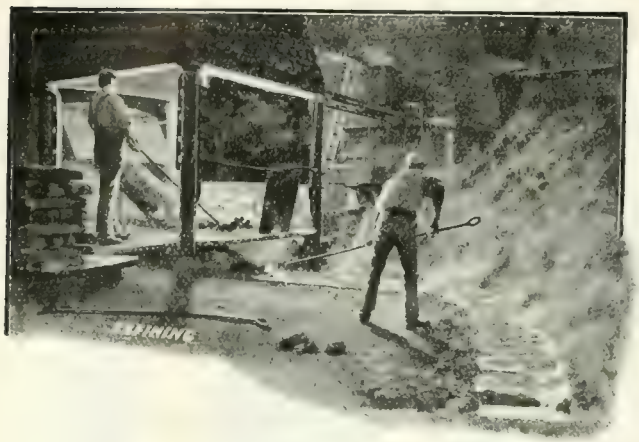

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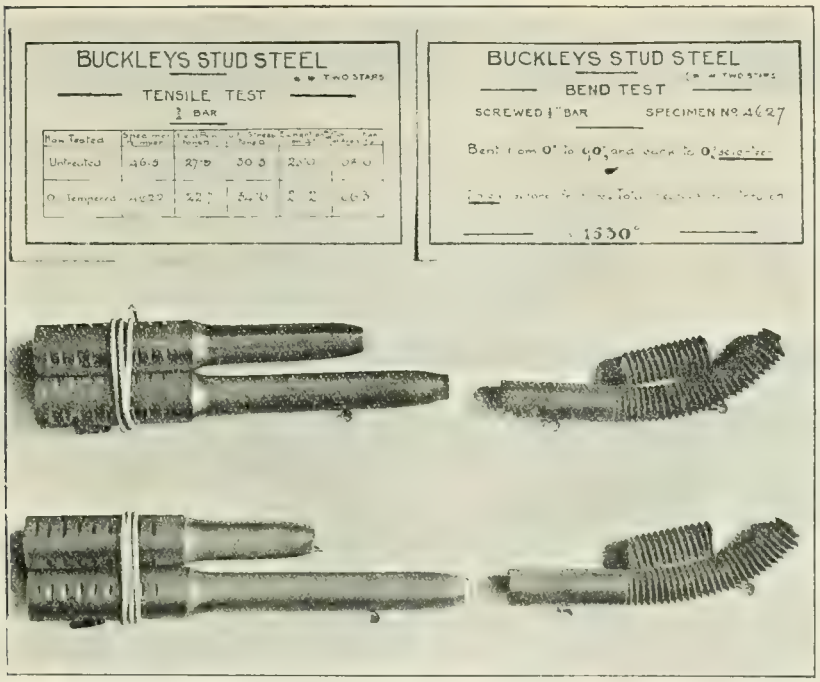

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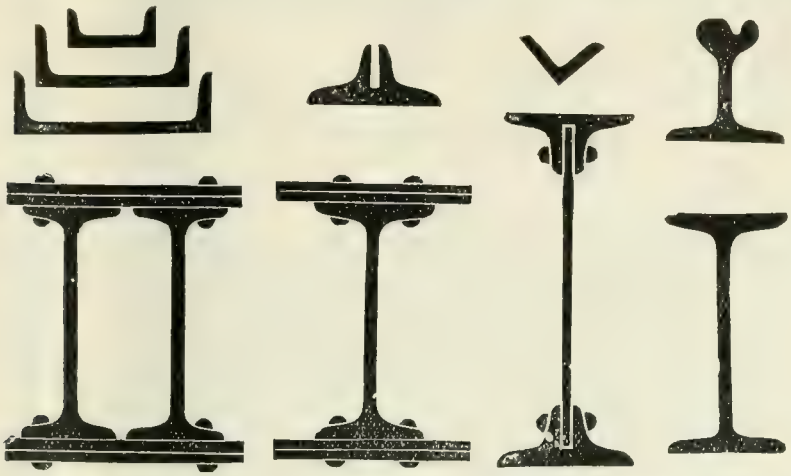

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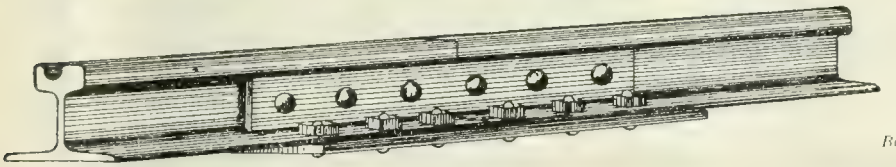

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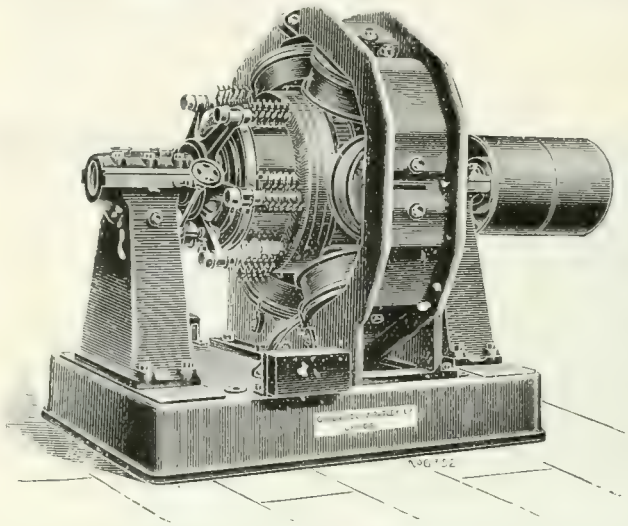

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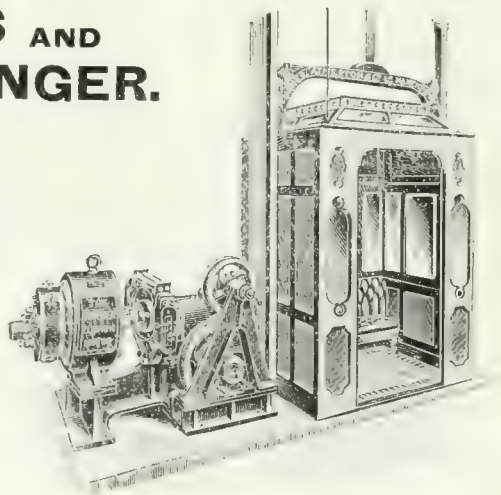

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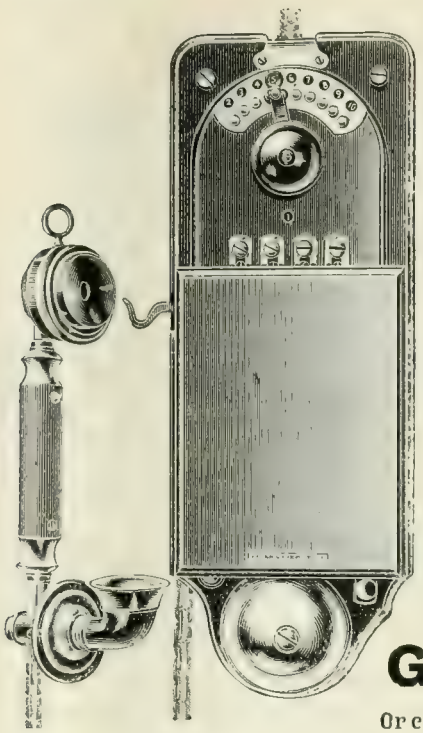

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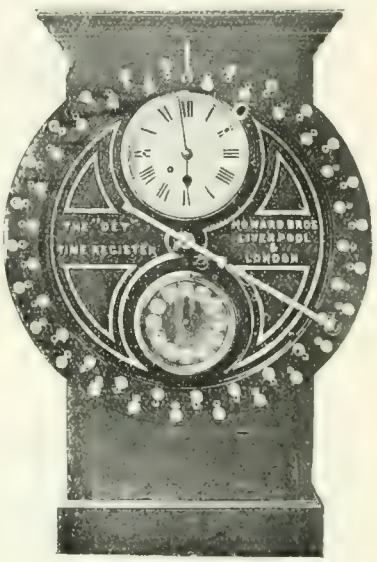

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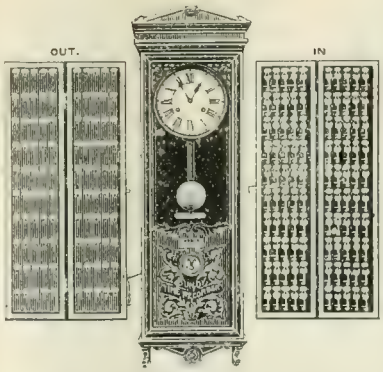

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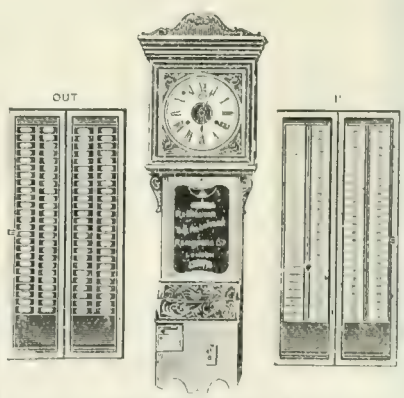

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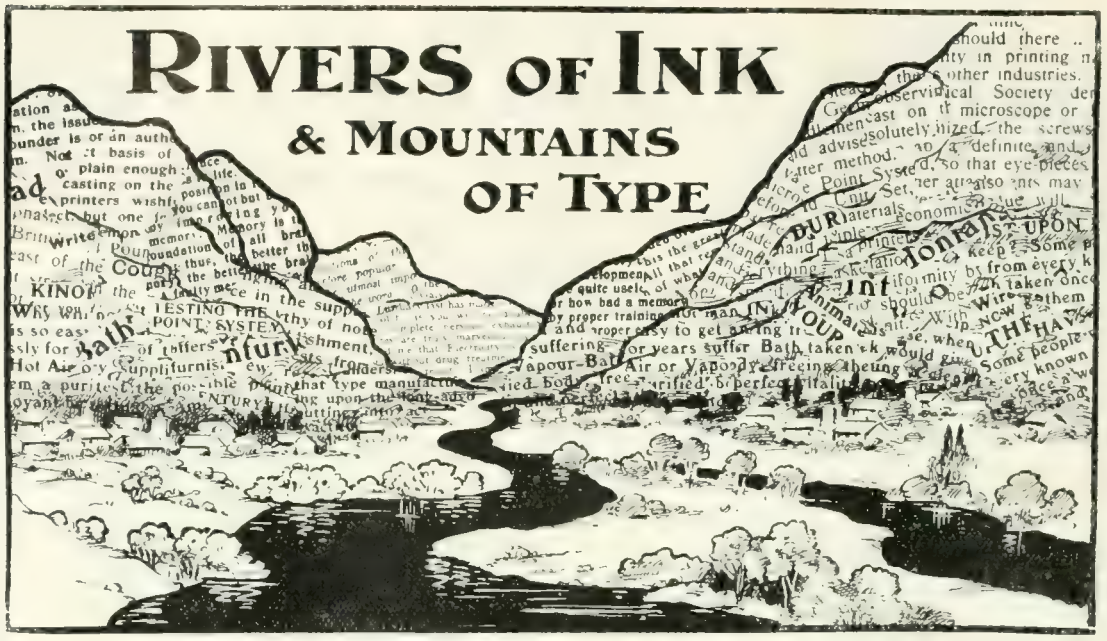

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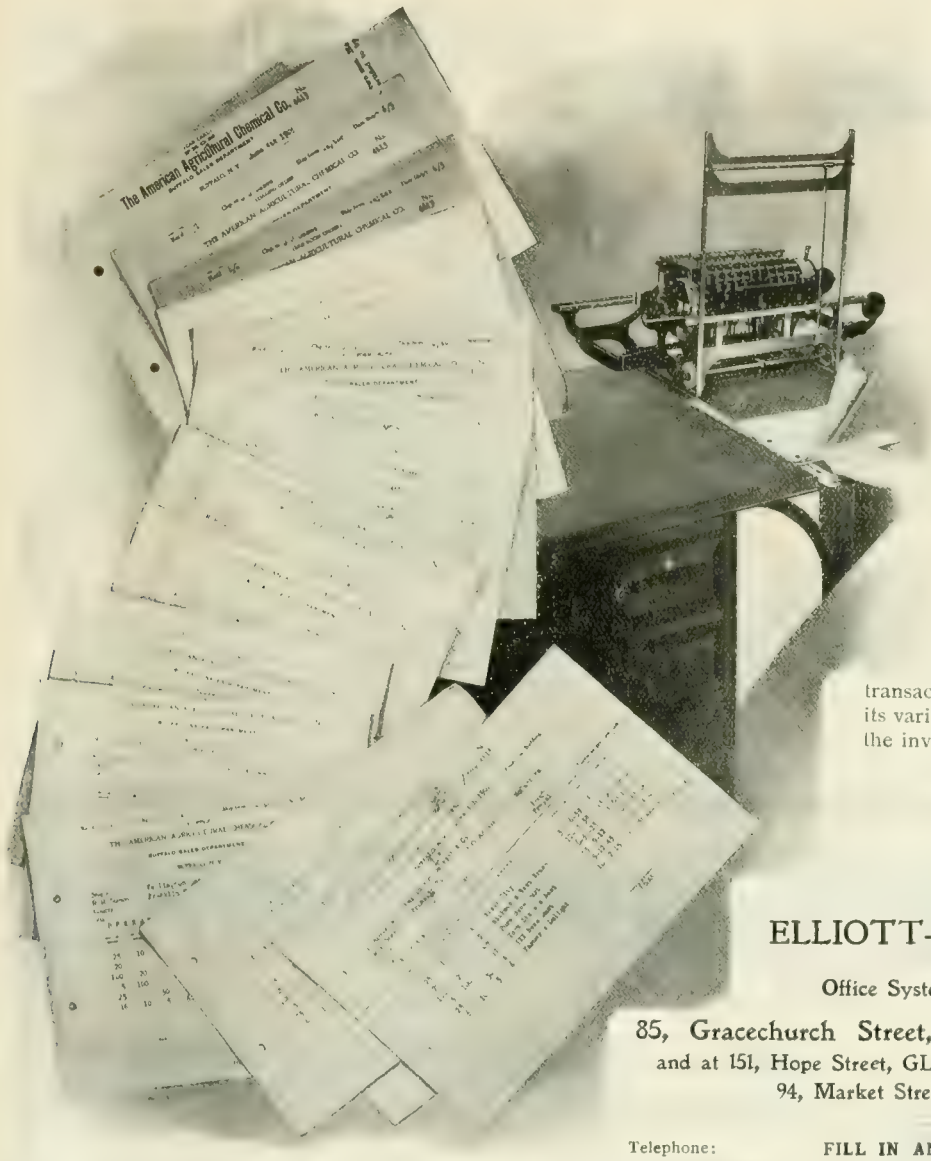

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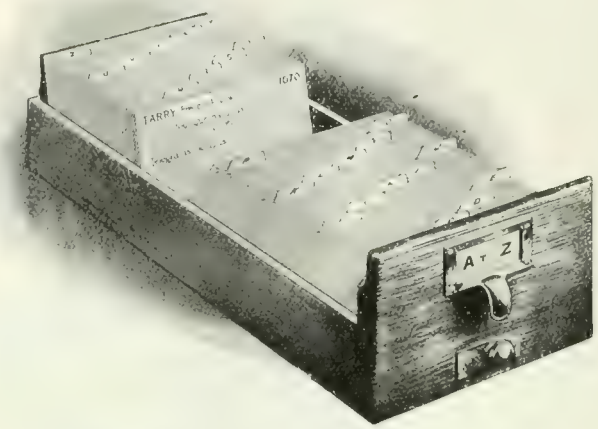

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